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NATIONAL DAM INSPECTION PROGRAM. HINCKSTON RUN DAM (NDS I.D. NU--ETC(U)
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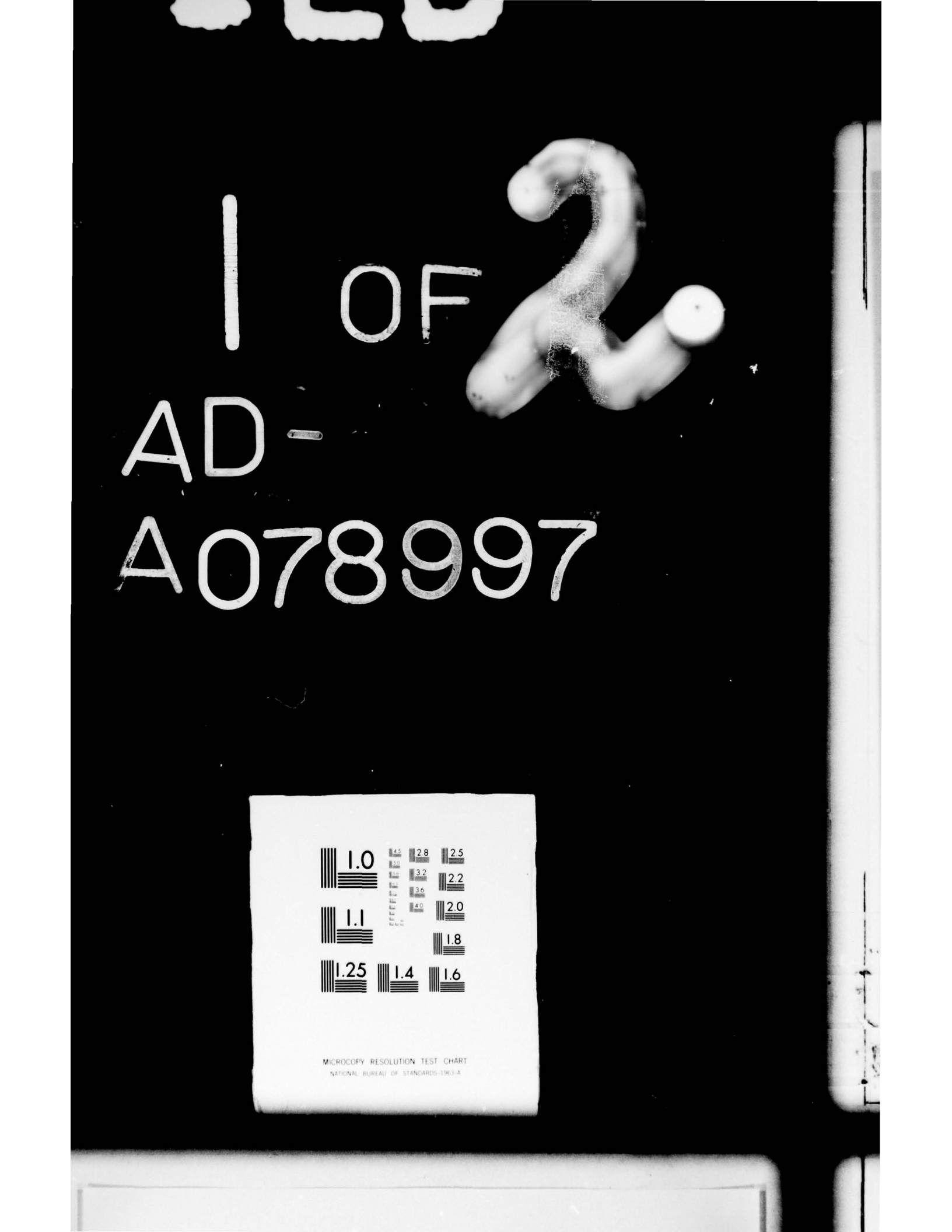
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OHIO RIVER BASIN

HINCKSTON RUN, CAMBRIA COUNTY

PENNSYLVANIA

HINCKSTON RUN DAM

LEVEL

NDS I.D. No. PA-00430

PENNDER I.D. No. 11-9

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

SEPTEMBER 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Hinckston Run Dam: NDI I.D. No. PA-00430

Owner:	Manufacturers Water Company
State Located:	Pennsylvania (PennDER I.D. No. 11-9)
County Located:	Cambria
Stream:	Hinckston Run
Inspection Date:	8 August 1979
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

(10) Bernard M. /Mihalcin

Based on a visual inspection, review of post-construction engineering studies, and available engineering data, the Hinckston Run Dam is considered to be in good condition.

Deficiencies were limited to general deterioration of the concrete spillway section, and apparent inoperability of the valves within the intake tower. (11) Sep 79

The size classification of the facility is intermediate, and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility is the Probable Maximum Flood (PMF). Results of the hydrologic and hydraulic analysis indicate the facility can pass and/or store about 38 percent of the PMF prior to overtopping of the embankment. Overtopping, even under floods of PMF magnitude, is not expected to cause failure of the unusually massive embankment configuration which is composed of erosion-resistant, hot-poured slag. Thus, the spillway system is considered to be inadequate, but not seriously inadequate. (12) 95

(6) National Dam Inspection Program. Hinckston Run Dam (NDS I.D. Number PA-00430, PennDer I.D. Number 11-9), Ohio River Basin, Hinckston Run, Cambria County, Pennsylvania. Phase I Inspection ~~II~~ Report,

(15) DACW31-79-C-0013

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It is recommended that the owner:

a. Rehabilitate the spillway overflow structure. Remedial work should include, but not be limited to, restoring spalled surfaces, sealing structural cracks, replacing the concrete apron slabs, and controlling the apparent seepage through the rock strata under the weir structure.

b. Rehabilitate the valves within the intake tower to provide upstream control of the outlet system, or develop a plan to provide upstream control should an emergency situation develop within the outlet pipes upstream of the existing valve house.

c. Develop formal manuals of operations and maintenance to ensure continued evaluation and operability of the facility.

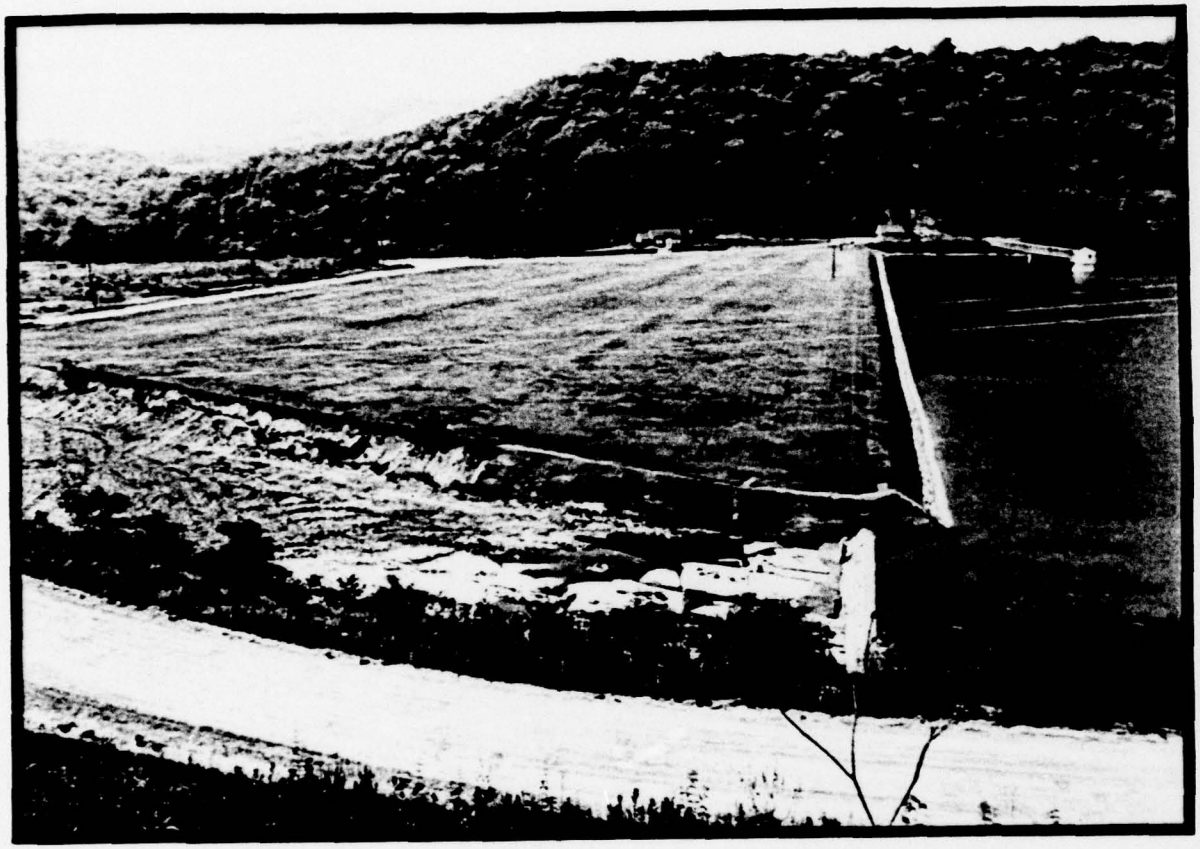
GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Approved by:

Date 17 Sept 1979

Date 25 Sep 79



OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
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HINCKSTON RUN DAM
NDI# PA-00430, PENNDER# 11-9

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Hinckston Run Dam is a zoned earth and slag fill embankment with a central concrete core wall. The embankment measures 890 feet long (excluding spillway), and the design and measured height is approximately 84 feet. The spillway of the facility is a free overfall, concrete, trapezoidal-shaped weir structure that discharges into a gently sloped open channel. The spillway is located at the left abutment and the weir crest measures 93 feet in length. A steel-lined intake tower is located upstream of the right abutment and provides water supply and drawdown capabilities via two 40-inch diameter cast iron conduits.

The facility is unique in that the downstream shell area has been utilized as a slag dump (see Figure 3), which has resulted in a minimum embankment crest width of 360 feet (see Overview Photograph and Figure 1).

b. Location. Hinckston Run Dam is located on Hinckston Run, in East Taylor Township, Cambria County, Pennsylvania, about 3.5 miles upstream from Hinckston Run's confluence with the Conemaugh River (just north of Johnstown, Pennsylvania). The dam, reservoir and watershed are contained within the Johnstown, Nanty Glo, Geistown, and Vintondale,

Pennsylvania, U.S.G.S. 7.5 minute topographic quadrangles (see Appendix G). The coordinates of the dam are N 40° 22' and W 78° 53'.

c. Size Classification. Intermediate (84 feet high; 4,010 acre-feet storage capacity at top of dam.

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Manufacturers Water Co.
119 Walnut Street
Johnstown, Pennsylvania 15907

f. Purpose. Industrial water supply.

g. Historical Data. A comprehensive historical report dated June 2, 1914 is available in PennDER files. The report indicates that the Hinckston Run Dam was designed for the Manufacturers Water Co., then a wholly owned subsidiary of the Cambria Steel Co., by John Birkinbine of Philadelphia, Pennsylvania. Clearing of the reservoir area began in 1900, and actual work on the dam began in 1901. The facility was completed in 1905. The report further indicates that Mr. Harrison Souder was engaged as resident engineer and superintendent of construction, while Mr. Birkinbine periodically inspected the site during construction.

The report also indicates that construction of the downstream shell was modified when the height of the "ordinary fill" reached about 22 feet (see Figure 4). At that level, the downstream shell area, and eventually much of the valley below the dam, was backfilled with hot-poured slag (termed "cinders" in the historical correspondence). The downstream shell is designated as the "Rider's Dump Area" in Figure 3. Discussion and correspondence with the owner's representatives indicate that modifications have been made to the appurtenant structures, and that the available drawings are old and may not accurately represent the existing conditions. Some drawings are, however, included within this report to provide general concepts of the overall design.

1.3 Pertinent Data.

a. Drainage Area (square miles). 10.6

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduits--not available.

Discharge Capacity of Spillway at Maximum Pool ≅ 4550 cfs (see Appendix C, Sheet 9).

c. Elevation (feet above mean sea level). The following elevations were obtained from available drawings and field measurements based on the elevation of the spillway crest at elevation 1395 feet.

Top of Dam	1401.7 (design) 1401.1 (field)
Maximum Design Pool	Not known
Maximum Pool of Record	1402 (July 1977)
Normal Pool	1395
Spillway Crest	1395
Upstream Inlet Invert	1322
Downstream Outlet Invert	1317
Streambed at Dam Centerline	1319
Maximum Tailwater	Not known

d. Reservoir Length (miles).

Top of Dam	1.1
Normal Pool	1.0

e. Storage (acre-feet).

Top of Dam	4010
Normal Pool	3340
Design Surcharge	Not known

f. Reservoir Surface (acres).

Top of Dam	122
Normal Pool	104
Design Surcharge	Not known

g. Dam.

Type	Zoned earth with concrete core wall and massive dumped slag toe area.
Length	890 feet (field measured, excluding spillway).
Height	84 feet (field measured; crest to invert of blowoff outlet).

Top Width	Varies; 360 feet minimum width, to over 1,000 feet maximum width.
Upstream Slope	Lower upstream 2-1/4H:1V Upper upstream 1-3/4H:1V
Downstream Slopes	Varies.
Zoning	Historical data indicates zones of puddle clay, selected material, and cinder (hot-poured slag) fill.
Impervious Core	Central core comprised of concrete core wall encased in clay puddle.
Cutoff	Concrete core wall on rock along centerline of dam. A smaller core wall (4 feet wide and 6 feet deep) reportedly exists at the upstream toe.
Grout Curtain	Grout curtain along base of concrete core wall consisting of 2-inch diameter holes, 10 to 16 feet in depth, on 1-foot centers. Cement grout poured into holes and pneumatically pressurized from 30 to 60 pounds.

h. Diversion Canal and Regulating Tunnels. None.

i. Spillway.

Type	Free overfall, concrete, trapezoidal-shaped weir structure that discharges into a gently sloping channel.
Crest Elevation	1395 feet
Crest Length	93 feet (field measured).

j. Outlet Works — Two 40-inch diameter cast iron pipes (supply and blowoff) encased in concrete and supported by concrete piers with cutoff collars.

Length	Approximately 800 feet from intake tower to downstream valve house.
Closure and Regulating Facilities	Valves are located within intake tower, but are reportedly inoperable. Control is provided by valves in downstream valve house (see Figure 6).
Access	Intake tower accessible by foot bridge from right bank of reservoir (see Photograph 3). Valve house accessible via roadways.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No design reports or calculations are available for any aspects of the original facility. Many old drawings are available from the owner's files; however, their accuracy is questioned by the owner. Design features and pertinent details of construction are available in the following sources:

1. "Report Upon the Dam of the Manufacturers Water Company" by the Water Supply Commission of Pennsylvania dated June 2, 1914 and available in PennDER files. Excellent historical account.

2. "Report on Hinckston Run Dam" by Hydrotechnic Corporation, dated May 1918, and available from the owner. This report inclues a foundation investigation by Greer Engineering Associates, Inc., which confirms various design features.

3. "Preliminary Evaluation of Hinckston Run Dam" by D'Appolonia Consulting Engineers, Inc., dated July 10, 1979. This report is basically a Phase I evaluation of the facility.

b. Design Features.

1. Embankment. An historical account in PennDER files (as listed above) indicates that the embankment was designed and constructed as a zoned earth fill with a central concrete cutoff and core wall flanked by clay puddle and selected materials. The description generally conforms to the section presented on Figure 4.

The upstream embankment portion is primarily composed of selected material encased by clay puddle, with the slope protected by cinder (probably slag) below elevation 1372, and by hand-placed stone riprap above. The embankment materials were reportedly "spread in 6-inch to 8-inch layers, sprinkled when necessary, and compacted by a 10-ton steam grooved roller".

The main cutoff wall consists of a stepped concrete structure founded on rock and extending to elevation 1348 (53 feet below the design top of dam). A grout curtain consisting of 2-inch diameter holes, 10 to 16 feet in depth,

on 1-foot centers and filled with pneumatically pressurized pure cement grout was also included.

The downstream portion of the embankment was modified during construction when the "ordinary fill" reportedly reached a height of 22 feet, at which point it was decided to use "cinder" (currently designated as hot-poured slag) as its replacement by utilizing the downstream area as a slag dump. Thus, the embankment with its present configuration, is a unique, massive, slag-buttressed facility with a minimum crest width of about 360 feet (at the right abutment).

2. Appurtenant Structures.

a. Spillway. The spillway weir discharges into an open channel which was cut into rock along the left abutment, and is partially lined along the embankment (see Photographs 5 and 6). The overflow weir is a concrete, trapezoidal-shaped structure with visible portions generally conforming to the sections presented on Figure 5. The measured length of the weir crest is approximately 93 feet. The flashboards and supports indicated on Figure 5 have been removed.

b. Outlet Works. The outlet works are composed of an intake tower, concrete encased conduits, and a downstream valve house. The intake tower is a cylindrical steel shell (varying from 19 to 23 feet in diameter) which is lined with concrete, and rests on a 28-foot diameter, 7-foot thick masonry foundation. It is located along the upstream toe of the embankment about 200 feet from the right (west) end of the dam. Within the tower, at the operating floor level, are five valve stands previously used to control intake levels and blowoff operation (see Figure 6 and Photograph 9). Modifications have been made to the intakes and all remaining valves are reportedly opened, but probably inoperable.

Two 40-inch diameter cast iron pipes (blowoff and supply lines) originate upstream of the intake tower, pass through it, and proceed to the downstream valve house. The pipes are reportedly encased in concrete and supported on concrete pedestals with cutoff collars under the upstream section of the embankment.

At the valve house, piping arrangements are such that either of the 40-inch diameter conduits can be utilized for blowoff or supply purposes. The supply line then continues as a 24-inch main to the downstream industrial facility.

Control of blowoff capabilities within the valve house is by electrically operated valves (see Photograph 10).

c. Specific Design Data and Criteria.

1. Hydrology and Hydraulics. No design data or criteria are available concerning the present spillway configuration.

2. Embankment. Other than concrete mixes and compaction criteria, no design data are available for the original embankment.

3. Appurtenant Structures. No design data are available.

2.2 Construction Records.

No formal construction records are available; however, available drawings are substantiated by an historical account of construction contained in the previously mentioned report in PennDER files, dated June 2, 1914.

2.3 Operational Records.

Daily records of operation are maintained by the owner's full-time dam tender who resides on site.

2.4 Other Investigations.

Reports concerning two relatively recent investigations are available from the owner. These are:

a. "Report on Hinckston Run Dam" dated May 1918, by Hydrotechnic Corporation of New York City.

b. "Preliminary Evaluation of Hinckston Run Dam" by D'Appolonia Consulting Engineers of Pittsburgh, Pennsylvania, dated July 10, 1979.

2.5 Evaluation.

Detailed historical accounts within PennDER files, drawings, and recent studies available from the owner, indicate the facility is designed in accordance with generally accepted standards. The data available are sufficient to make a reasonable Phase I assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observation.

a. General. The general appearance of the facility suggests that it is well maintained and in good condition.

b. Embankment. Visual inspection indicated that the embankment is in good condition (see Photograph 1). The upstream slope is well-aligned and adequately protected by hand-placed sandstone riprap (see Photograph 3). The crest is grass covered and well maintained, and the downstream slope consists of a massive accumulation of dumped hot-poured slag.

The owner's representatives report that the embankment was overtopped by an estimated 1-foot of flow during the flood of July 1977. The overtopping caused no damage to the vegetated crest and only minor erosion of the massive downstream slope.

Seepage has been historically noted at two locations about 100 and 150 feet, respectively, downstream from the valve house. These seeps are currently being monitored via recently constructed standard weirs. At the time of inspection, one of the weirs was not discharging, while the other was passing about 13 gallons per minute.

c. Appurtenant Structures.

1. Spillway. The spillway is considered to be in fair condition, suffering from overall concrete deterioration and a general lack of maintenance, particularly along the weir section. Deficiencies of the weir section include spalling, structural cracking and seepage below the base (apparently through the extensive jointing of the exposed bedrock surface). A minor rockfall is also obstructing the weir along the left abutment. The spillway channel is cut into rock and is concrete lined for a distance of about 90 feet along the right spillway sidewall. Downstream from the spillway channel has been recently graded and contains loose earth and rock fill. Bedrock is reportedly near the surface of the channel bottom and the wall formed by the embankment is composed of a resistant slag fill.

Approximately 1,200 feet downstream from the spillway weir the channel bends and is cut into the slag fill until

it terminates at a 60-foot overfall into the original stream channel (see Photograph 7).

2. Outlet Works. The intake tower and valve house were observed to be in good condition (see Photographs 3 and 8). The blowoff line was operated from within the valve house during inspection via an electrical valve mechanism (see Photographs 10 and 11). Valves in the intake tower are reportedly opened and probably inoperable. The owner's representatives also indicated that some modifications have been made to the intake system within the tower (no as-built drawings are available).

d. Reservoir Area. The area immediately surrounding the reservoir is characterized by steep and heavily forested slopes (see Photograph 2). The watershed (10.6 square miles) is comprised, however, of about 50 percent forested and 50 percent agricultural lands.

e. Downstream Channel. Downstream from the dam, Hinckston Run is confined in a steep, narrow valley, and empties into the Conemaugh River within the Bethlehem Steel property in the community of Minersville, just north of Johnstown, Pennsylvania. Near the confluence are many residences and active industrial structures (see Photograph 4) which could be affected by the large flows usually associated with an embankment failure. Thus, the hazard classification of the facility is considered to be high.

3.2 Evaluation.

The overall appearance of the facility suggests it to be in good condition and generally well maintained except for the spillway weir structure. Noted Deficiencies of the weir structure include spalling and structurally cracked concrete, and underseepage (apparently through the exposed, jointed bedrock). The valves within the intake tower are also reportedly inoperable.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

Hinckston Run Dam is essentially a self-regulating facility with excess inflow discharged over the uncontrolled concrete spillway structure. No formal operating manuals are associated with the facility; however, daily records of operation are kept by the dam tender.

4.2 Maintenance of Dam.

Maintenance of the facility is provided by a full-time dam tender who resides on-site, and by additional summer help. There are no formal manuals detailing maintenance requirements.

4.3 Maintenance of Operating Facilities.

See Item 4.2 above.

4.4 Warning System.

A warning system is reportedly being developed in conjunction with the Cambria County Emergency Management Agency.

4.5 Evaluation.

The facility is maintained by a full-time dam tender, and by additional summer help on an informal basis. Daily records of operation are kept and a warning system is being developed. Formal manuals of operation and maintenance are recommended to ensure contained care and proper maintenance of the embankment and appurtenances.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design reports or calculations are available for the facility.

5.2 Experience Data.

The owner's representatives report that the dam was overtopped by an estimated 1-foot of flow during the flood of July 1977. Visual inspection indicated that damage due to erosion during the overtopping incident was insignificant.

5.3 Visual Observations.

The visual inspection of the spillway indicated that it is in fair condition due to the general deterioration of the concrete weir structure. Since the spillway is cut into rock and/or confined by the massive slag fill, failure of the weir structure would probably be inconsequential. Nevertheless, remedial repairs are recommended to minimize possible damage.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U. S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix C.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Hinckston Run

Dam is the Probable Maximum Flood (PMF). That is, based on the relative size (intermediate), and the hazard potential (high) of the dam, the facility is required to have sufficient discharge and storage capabilities to safely pass the PMF without embankment overtopping.

b. Results of Analysis. Hinckston Run Dam was evaluated under normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of 1395.0 feet, with the spillway weir discharging freely, and the blowoff line closed. The design reservoir elevation-storage relationship for elevations up to about 1,401 feet was available and used in the analysis. The spillway is a free overfall, concrete, trapezoidal-shaped weir structure that discharges into a gently sloped open channel. A backwater curve was computed to ascertain the affects of tailwater on weir discharges. All pertinent engineering calculations relative to the evaluation of this facility are provided in Appendix C.

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Hinckston Run Dam can accommodate only about 38 percent of the PMF (SDF) prior to overtopping of the embankment (Appendix C, Summary Input/ Output Sheets, Sheet H). The peak PMF inflow of approximately 12810 cfs was slightly attenuated by the discharge/ storage capabilities of the dam and reservoir such that the resulting peak PMF outflow was about 12710 cfs (Summary Input/Output Sheets, Sheets F and G). Under the PMF, the embankment will be overtopped for approximately 13.5 hours, with a maximum depth of inundation of about 2.6 feet above the low top of dam elevation of 1401.1 feet (Summary Input/Output Sheets, Sheet H).

5.6 Spillway Adequacy.

As indicated in the above analysis, the spillway system of Hinckston Run Dam can accommodate only about 38 percent of the PMF (the SDF) prior to overtopping of the embankment. Overtopping, however, under any anticipated flooding is not expected to cause embankment failure since the downstream portion of the embankment consists of a massive dumped slag fill. Therefore, the spillway is considered to be inadequate, but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment is considered to be in good condition, and is well maintained. Seepage currently being monitored by weirs at two locations downstream from the valve house, is considered to be minor.

b. Appurtenant Structures.

1. Spillway. The spillway is considered to be in fair condition due to the general deterioration of the concrete overflow weir. Failure of the weir, however, would be inconsequential as the spillway channel is cut into rock and confined by the resistant slag fill comprising the embankment.

2. Outlet Works. The outlet works were found to be in good condition, with the only deficiency noted being that the valves in the intake tower are reportedly inoperable. Thus, there is no means for controlling flow at the inlet end should the supply conduits rupture between the tower and the valve house.

6.2 Design and Construction Techniques.

Historical accounts, drawings, and recent engineering evaluations indicate that the design and construction of the facility were adequate, in that they entailed the essential elements of earth dam construction.

6.3 Past Performance.

Available data indicates that past performance has been adequate. The embankment was overtopped by approximately 1-foot of water during the flood of July 1977, and suffered only minor erosion damage.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and is subject to minor earthquake induced dyanamic forces. Due to

its unique, massive downstream configuration and composition, it is believed that the facility can withstand the expected dynamic forces; however, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection suggests that the facility is in good condition with only minor deficiencies noted. The size classification of the facility is intermediate and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility is the Probable Maximum Flood (PMF). Results of the hydrologic and hydraulic analysis indicates the facility can pass and/or store only about 38 percent of the PMF prior to embankment overtopping. Overtopping, however, even under floods of PMF magnitude, is not expected to cause failure of the unusual massive embankment configuration which is composed of an erosion-resistant dump of hot-poured slag. Thus, the spillway system is considered to be inadequate, but not seriously inadequate.

Deficiencies noted by the inspection team were limited to general deterioration of the concrete sections of the spillway, and inoperable valves in the intake tower structure.

b. Adequacy of Information. Available data are considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. Recommendations listed below should be implemented as soon as possible.

d. Necessity for Additional Investigations. No additional investigations are considered necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Rehabilitate the spillway overflow structure. Remedial work should include, but not be limited to, restoring spalled surfaces, sealing structural cracks, replacing the concrete apron slabs, and controlling the apparent seepage through the rock strata under the weir structure.

b. Rehabilitate the valves within the intake tower to provide upstream control of the outlet system, or develop a

plan to provide upstream control should an emergency situation develop within the outlet pipes upstream of the existing valve house.

c. Develop formal manuals of operations and maintenance to ensure continued evaluation and operability of the facility.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: Hinckston Run Dam

NDI#: PA-430 PENNDER# : 11-9

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 430
PERSONS INTERVIEWED AND TITLE	B. C. Barger - Manager, Manufacturers Water Company R. L. Dunchock - Staff Engineer, Manufacturers Water Company
REGIONAL VICINITY MAP	See Appendix G (U.S.G.S. 7.5 minute topographic quadrangles: Johnstown, Geistown, Nanty Glo, and Vintondale, Pennsylvania)
CONSTRUCTION HISTORY	Excellent historical review available in PennDER files entitled, "Report Upon the Dam of the Manufacturers Water Company located on Hinckston Run, near Johnstown, Cambria County, Pennsylvania," dated June 2, 1914.
AVAILABLE DRAWINGS	1. 1977 Aerial topographic map of dam and downstream area ("Riders Dump"). 2. Many original drawings available from Manufacturers Water Company but none are known to be as-built. 3. Several drawings in report of May 1958 by Hydrotechnics Corporation.
TYPICAL DAM SECTIONS	Hydrotechnic Corporation drawing number JHD-2 based on reference drawing dated February 12, 1908. (see Figure 4).
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figure 4, Appendix F. See Figures 4 and 6, Appendix F. Not available.

ITEM	REMARKS NDI# PA - 430
SPILLWAY: PLAN SECTION DETAILS	See Figures 3 and 4, Appendix F. See Figure 5, Appendix F.
OPERATING EQUIPMENT PLANS AND DETAILS	No current as-built drawings. Inlets in intake tower have been modified. No details available. Blowoff valve electrically operated.
DESIGN REPORTS	None on original design.
GEOLOGY REPORTS	Geology briefly discussed in report by Water Supply Commission of Pennsylvania, dated June 2, 1914.
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available for original design.
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Foundation borings briefly discussed in report by Water Supply Commission dated 1914. A detailed foundation investigation of the existing facility (including 7 borings) by Greer Associates, Inc. of Montclair, New Jersey (dated March 1958) is available from the owner.

ITEM	REMARKS NDI# PA -
BORROW SOURCES	Soil sources from within reservoir area below pool level. Downstream area is massive dump of hot-poued slag (frequently referred to as "cinders" in historical data) from Bethlehem Steel (previously Cambria Steel) plant.
POST CONSTRUCTION DAM SURVEYS	A topographic map (dated July 1977) prepared from aerial photography of March 29, 1977 is available from the owner. (See Figure 3, Appendix F).
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1. Feasibility study by Hydrotechnic Corporation dated May 1958 which includes foundation investigation by Greer Engineering Associates of Montclair, New Jersey. 2. Preliminary evaluation (Phase I Study) by D'Appolonia Consulting Engineers, Inc., dated July 10, 1979.
HIGH POOL RECORDS	Embankment overtopped by approximately 1- foot on July 20, 1977 (Estimated by dam tender).
MONITORING SYSTEMS	Full-time dam tender on-site. Rainfall, pool elevation, temperature, and supply outflow records are kept on a daily basis. Two weirs to monitor seepage downstream of valve house are read on regular basis (installed in July 1979) to evaluate seepage.
MODIFICATIONS	1. The inlets at the intake tower have been modified; but as-built records are not available. 2. Two standard V-notch weirs have been installed (July 1979) to monitor seepage downstream of the valve house.

ITEM	REMARKS NDI# PA - 430
PRIOR ACCIDENTS OR FAILURES	Overtopped in July 1977. No significant damage to embankment.
MAINTENANCE: RECORDS MANUAL	Full-time on-site dam tender and summer help keep the facility well maintained. There is no formal manual nor are regular maintenance records kept.
OPERATION: RECORDS MANUAL	Daily records of operation are kept by the full-time dam tender. There is no formal operations manual.
OPERATIONAL PROCEDURES	Supply is controlled by steel mill demand. Facility is otherwise self-regulating.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Warning system is being currently developed in conjunction with the Cambria County Emergency Management Agency.
MISCELLANEOUS	All available inlets in intake tower are open and valves are probably inoperable. Discharge controlled in downstream valve house.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00430
PENN DER ID # 11-9

SIZE OF DRAINAGE AREA: 10.6 square miles

ELEVATION TOP NORMAL POOL: 1395 STORAGE CAPACITY: 3340 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: -- STORAGE CAPACITY: --

ELEVATION MAXIMUM DESIGN POOL: -- STORAGE CAPACITY: --

ELEVATION TOP DAM: 1401.1 STORAGE CAPACITY: 4010 acre-feet

SPILLWAY DATA

CREST ELEVATION: 1395

TYPE: Free overfall, trapezoidal-shaped weir structure that discharges into a gently sloped open channel.

CREST WIDTH: 93 feet

CHANNEL LENGTH: 1800 feet

SPILLOVER LOCATION: Left abutment.

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: Two 40-inch diameter cast iron pipes encased in concrete.

LOCATION: Near right abutment.

ENTRANCE INVERTS: Approximately 1322.

EXIT INVERTS: Approximately 1317.

EMERGENCY DRAWDOWN FACILITIES: Both 40-inch diameter pipes can be used as blowoffs.

HYDROMETEOROLOGICAL GAGES

TYPE: Rain and temperature gages.

LOCATION: At dam.

RECORDS: Kept daily by dam tender.

MAXIMUM NON-DAMAGING DISCHARGE: 1-foot over embankment (July 1977).

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Hinckston Run Dam STATE Pennsylvania COUNTY Cambria

NDI# PA - 00430 PENNDER# 11-9

TYPE OF DAM zoned earth and slag fill SIZE intermediate HAZARD CATAGORY high

DATE(S) INSPECTION 8 August 1979 WEATHER hot/humid TEMPERATURE 85° @ noon

POOL ELEVATION AT TIME OF INSPECTION 1393.8 M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. Mihalcin	Rudy Bozic (Dam Tender)	
W. Veon	Robert L. Dunchock (Staff Engineer)	

RECORDED BY B. Mihalcin

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor surface erosion of crest about 360 feet downstream from reservoir, caused by the 1977 overtopping incident. The lack of any sign of serious erosion within that portion of the discharge channel that crosses the downstream slag shell surface indicates the durability of the slag fill.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Cood alignment both horizontally and vertically.
RIPRAP FAILURES	None observed. Riprap is durable, hand-placed cut stone on upstream embankment face.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed.
ANY NOTICEABLE SEEPAGE	Seepage at toe through slag fill about 100 feet downstream of valve house. Flow being monitored by recently installed weir (13 GPM at time of inspection).
STAFF GAGE AND RECORDER	None observed. Dam tender measures from known datum.
DRAINS	None observed.
	Second weir located about 150 feet downstream of valve house. No flow at time of inspection; however, a pool of water just up to the bottom of the "V-notch" was observed.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 430
INTAKE STRUCTURE	Intakes submerged. Intake tower and access bridge are in good condition.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Blowoff conduit is 40-inch diameter cast iron pipe with outflow controlled by electrically operated valve in downstream valve house.	
OUTLET STRUCTURE	Valve house along original stream bed about 700 feet from upstream edge of crest along right abutment. Structure in good condition.	
OUTLET CHANNEL	Unobstructed. Concrete lined for short distance from blowoff exit.	
GATE(S) AND OPERATIONAL EQUIPMENT	Valves in intake tower are reported to be opened, but inoperable. Valves in downstream valve house that are used to control flow are in good condition. Blowoff operated for inspection team.	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
TYPE AND CONDITION	Concrete and rock- and slag-lined discharge channel with a trapezoidal-shaped overflow weir. Concrete shows overall deterioration including cracking and spalling. Leakage occurring under weir through jointing in shaley siltstone bedrock.
APPROACH CHANNEL	Unobstructed, cut in rock with forebay depth of about 2 feet.
SPILLWAY CHANNEL AND SIDEWALLS	Right sidewall is concrete lined for approximately 90 feet, then continues as the hot-poured slag embankment side. Left sidewall is near vertical rock cut for a few hundred feet. Rockfall at left side of weir has obstructed approximately 7 feet of weir crest.
STILLING BASIN PLUNGE POOL	Natural plunge pool at the bottom of the 60-foot falls section located at the end of the 1300-foot discharge channel.
DISCHARGE CHANNEL	Trapezoidal-shaped channel lined by rock and/or slag. An access bridge spans the channel at about 490 feet downstream from the weir crest. The discharge channel terminates at a 60-foot section which discharges into Hinckston Run.
BRIDGE AND PIERS	None above or along weir.
EMERGENCY GATES	None.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
TYPE AND CONDITION	N/A
APPROACH CHANNEL	N/A
OUTLET STRUCTURE	N/A
DISCHARGE CHANNEL	N/A

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
MONUMENTATION SURVEYS	None observed.
OBSERVATION WELLS	None.
WEIRS	Two weirs, located at 100 and 150 feet downstream from the valve house, to measure seepage through slag toe. Weir at 100 feet flowing at 13 GPM, while other weir not discharging. Seepage is insignificant with respect to integrity of embankment.
PIEZOMETERS	None.
OTHERS	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 430
SLOPES: RESERVOIR	Immediate reservoir slopes are steep and heavily forested.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Combined in narrow steep valley. No obstructions observed until stream enters the Bethlehem Steel Plant area where the stream is confined in a concrete-lined channel, and is crossed by a few bridges.
SLOPES: CHANNEL VALLEY	Channel and valley slopes are relatively steep.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Hinckston Run enters the Conemaugh River in the community of Minersville, within Bethlehem Steel property. An equipment repair shop and at least 10 homes are sufficiently close to the stream such that they could be affected by an embankment failure. Estimated population 30 to 40.

APPENDIX C

HYDROLOGY AND HYDRAULICS

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak, and maximum water surface elevation(s) of the failure hydrograph(s) for each location.

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

BY WJV DATE 9-1-79 PROJ. NO. 78-617-430

CHKD. BY DJS DATE 9-7-79 SHEET NO. 1 OF 18

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DAM STATISTICS

HEIGHT OF DAM ≈ 84 FT (FIELD MEASURED)
(MEASURED FROM LOW TOP OF DAM
EL 1401.1 TO BLOWOFF INVERT
EL 1317)

MAXIMUM POOL STORAGE CAPACITY ≈ 4010 AC-FT (SEE SHEET 4)
@ LOW TOP OF DAM

NORMAL POOL STORAGE CAPACITY ≈ 3340 AC-FT (SEE SHEET 4)

DRAINAGE AREA ≈ 10.6 SQ MI [PLANIMETERED OFF USGS 7.5 MINUTE JOHNSTOWN, GEISTOWN, VINTONDALE, AND NANTY GLO, PA QUADS]

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≈ 8.1 MI

L_{CA} ≈ 4.0 MI (MEASURED ALONG LONGEST WATERCOURSE FROM DAM CREST TO CENTROID OF BASIN)

NOTE 1: VALUES OF L AND L_{CA} ARE MEASURED FROM THE USGS 7.5 MINUTE JOHNSTOWN, VINTONDALE, AND NANTY GLO, PA QUADS. ALL VARIABLES ARE DEFINED IN REF 2, IN THE SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH".

C_t ≈ 1.6
C_p ≈ 0.45
[SUPPLIED BY COE; ZONE 24 OHIO RIVER BASIN]

t_p = SNYDER'S STANDARD LAG ≈ $1.6 (L \times L_{CA})^{0.3}$

∴ $t_p \approx 1.6 (8.1 \times 4.0)^{0.3} \approx 4.54$ HRS

RESERVOIR SURFACE AREAS

SURFACE AREA (SA) @ NORMAL POOL EL 1395.0 FT ≈ 104 AC

NOTE 2: NORMAL POOL SA OBTAINED FROM "REPORT UPON THE DAM OF THE MANUFACTURES WATER COMPANY, LOCATED ON HINCKSTON RUN, NEAR JOHNSTOWN, CAMERIA COUNTY, PA" DATED JUNE 2, 1914, AS FOUND IN PENNDER FILES. NORMAL POOL ELEVATION OBTAINED FROM APPENDIX F, FIGURE 5.

SA @ EL 1400.0 FT ≈ 120 AC
SA @ EL 1420.0 FT ≈ 162 AC
(PLANIMETERED OFF USGS 7.5 MINUTE JOHNSTOWN, VINTONDALE, AND NANTY GLO, PA QU

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LOW TOP OF DAM ELEVATION ≈ 1401.1 FT (FIELD MEASURED)

RATE OF SA INCREASE PER FOOT OF RESERVOIR RISE:

$$\Delta SA/\Delta H \approx (162-120)\,AC/(1420-1400)\,FT \approx 2.1\,AC/FT$$

$$SA @ EL\ 1401.1 \approx 120\,AC + [2.1\,AC/FT\,(1401.1\,FT - 1400\,FT)]$$
$$\approx 122\,AC$$

RESERVOIR ELEVATION-STORAGE RELATIONSHIP

RESERVOIR STORAGE VOLUMES BETWEEN ELEVATIONS 1323 FT AND 1401 FT (ASSUMED TO BE 1401.1 FT) ARE OBTAINED FROM FIGURES 4 AND 6 IN APPENDIX F.

RESERVOIR STORAGE VOLUMES FOR ELEVATIONS HIGHER THAN ABOUT 1401.1 FT CAN BE ESTIMATED BY THE MODIFIED PRISMOIDAL RELATIONSHIP:

$$\Delta V_{1\to2} \approx h/3\ (A_1 + A_2 + \sqrt{A_1 \times A_2}) \qquad (REF\ 14, PG\ 15)$$

WHERE $\Delta V_{1\to2}$ = INCREMENTAL VOLUME INCREASE BETWEEN ELEVATIONS 1 AND 2, IN FT;
h = ELEVATION 2 - ELEVATION 1, IN FT;
A_1 = SA @ ELEVATION 1, IN AC;
A_2 = SA @ ELEVATION 2, IN AC.

SA @ ANY ELEVATION CAN BE DEFINED BY:

$$A_i = A_o + [\Delta SA/\Delta H \times (ELEVATION_i - ELEVATION_o)]$$

WHERE A_i = SA @ ELEVATION i, IN AC;

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A_o = SA @ TOP OF DAM EL 1401.1 ≈ 122 AC;
$\Delta SA/\Delta H \approx$ 2.1 AC/FT
$ELEVATION_o$ = TOP OF DAM ELEVATION 1401.1 FT; AND
$ELEVATION_i$ = ELEVATION IN QUESTION, IN FT.

- ELEVATION - STORAGE RELATIONSHIP:

RESERVOIR ELEVATION (FT)	A_i (AC)	$\Delta V_{1\to 2}$ (AC-FT)	TOTAL VOLUME MODIFIED PRISMOIDAL (AC-FT)	TOTAL VOLUME DESIGN VALUES * (AC-FT)
1323			-	0
1333			-	40
1343			-	190
1353			-	480
1363			-	910
1373			-	1480
1383			-	2220
1393			-	3140
1395			-	3340
1396			-	3450
1397			-	3560
1398			-	3670
1399			-	3780
1400			-	3890
1401.1	122	-	4010	4010
1402	124	110	4120	
1403	126	120	4240	
1404	128	130	4370	
1405	130	130	4500	
1406	132	130	4630	

* DESIGN VALUES FROM FIG 4, CONVERTED FROM MG TO AC-FT.

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PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 24 IN (REF 3, FIG 1)
  (CORRESPONDING TO A DURATION OF 24 HOURS AND AN AREA OF 200 SQ MI IN SOUTHCENTRAL PENNSYLVANIA)

- DEPTH-AREA-DURATION ZONE #7 (REF 3, FIG 1)

- STORM WILL BE CENTERED OVER THE 10.6 SQ MI BASIN WITH A DEPTH-DURATION RELATIONSHIP OF:

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	102
12	120
24	130
48	140

(REF 3, FIG 2)

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER BASIN) CORRESPONDING TO A DA ≈ 10.6 SQ MI ⇒ 0.902 (FROM HEC-1)

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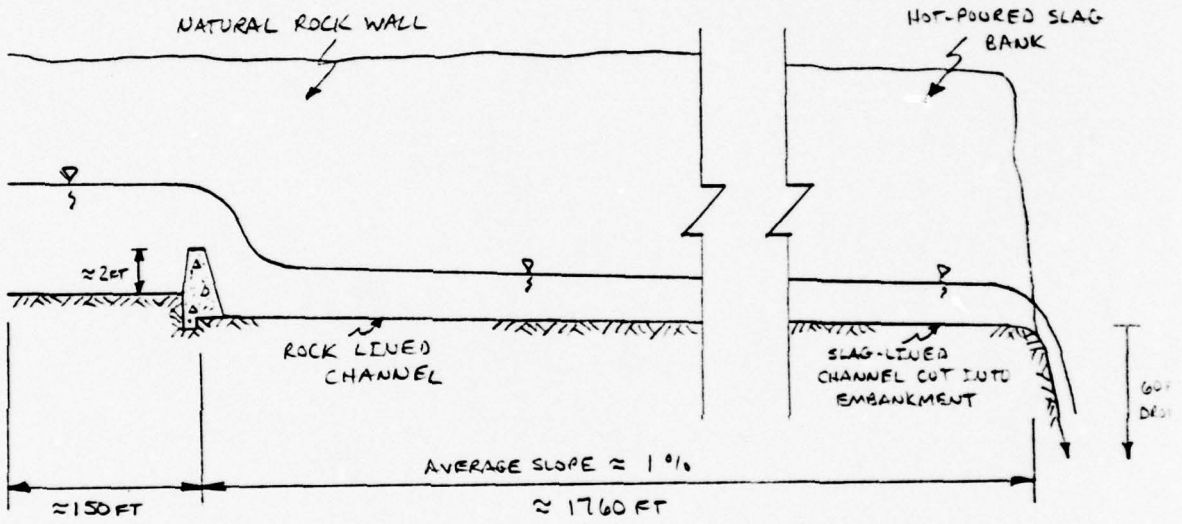
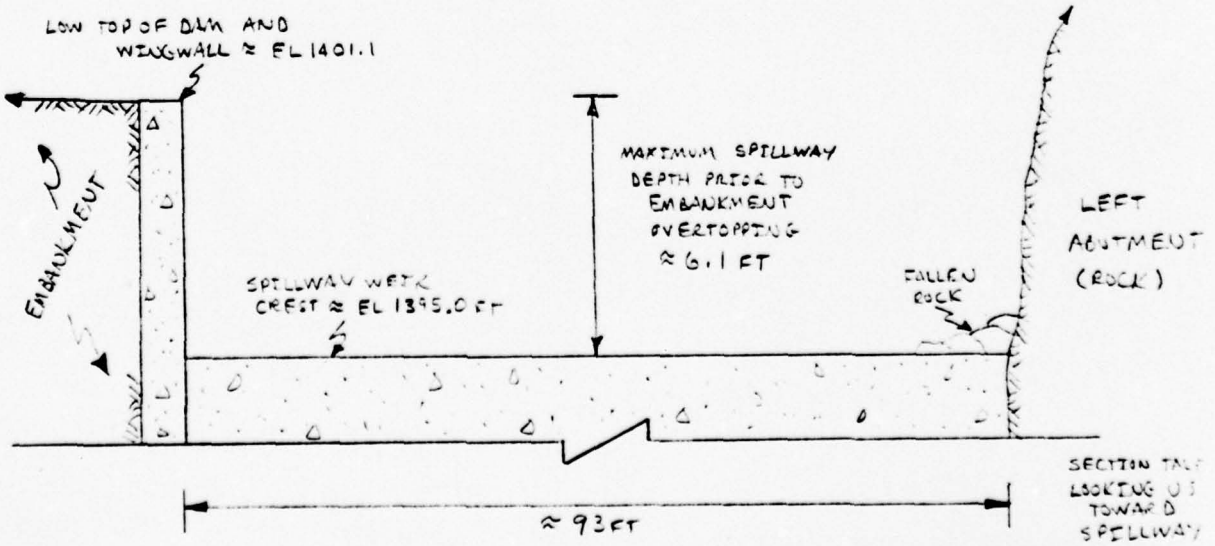
SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENTS AND OBSERVATIONS, AND FIGURES IN APPENDIX F)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENTS AND OBSERVATIONS, AND FIGURES IN APPENDIX F)



SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

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- THE SPILLWAY IS A FREE OVERFALL, CONCRETE, TRAPEZOIDAL-SHAPED WEIR STRUCTURE THAT DISCHARGES INTO AN OPEN CHANNEL. FLOW OVER THE WEIR CAN BE DEFINED BY:

$$Q = C L H^{3/2} \qquad \text{(REF 5, PG 5-3)}$$

WHERE Q = DISCHARGE OVER WEIR, IN CFS;
L = LENGTH OF WEIR CREST ≈ 93 FT;
H = HEIGHT OF RESERVOIR ABOVE SPILLWAY CREST EL 1395 FT, ASSUMED DESIGN HEAD (H_o) ≈ 6.1 FT;
C = DISCHARGE COEFFICIENT ≈ 3.7 @ DESIGN HEAD (REF 5, PGS 5-42 AND 5-43; BASED ON GEOMETRY)

- CONSIDER APPROACH CHANNEL LOSSES @ DESIGN FLOW:

a) APPROXIMATE APPROACH CHANNEL LENGTH = 150 FT
APPROACH CHANNEL WIDTH ≈ 120 FT
} FROM FIELD OBSERVATION AND OWNER'S FILES

LEFT SIDE OF APPROACH CHANNEL IS THE LEFT ROCK ABUTMENT WHICH EXTENDS AT LEAST 11 FT ABOVE THE WEIR FOR THE ENTIRE CHANNEL LENGTH. ASSUME AN AVERAGE 1H TO 1V SIDESLOPE (FROM FIELD OBSERVATIONS AND OWNERS FILES)

RIGHT SIDE OF APPROACH CHANNEL IS THE RIGHT SIDEWALL OF SPILLWAY WHICH EXTENDS TO THE TOP OF DAM ELEVATION. THEREFORE, MAXIMUM HEIGHT OF WINGWALL ≈ MAXIMUM APPROACH CHANNEL DEPTH. (FROM FIELD OBSERVATIONS AND OWNERS FILES)

∴ @ RESERVOIR EL 1401.1 FT (LOW TOP OF DAM) THE MAXIMUM APPROACH CHANNEL DEPTH = FOREBAY DEPTH + HEAD OVER WEIR CREST ≈ 2 FT + 6.1 FT ≈ 8.1 FT

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⇒ AVERAGE APPROACH CHANNEL FLOW AREA ≈ A_a

$$A_a \approx (120\,FT \times 8.1\,FT) + [\tfrac{1}{2}(8.1\,FT \times 8.1\,FT)]$$
$$\approx 1005\,FT^2$$

b) INITIAL ESTIMATE OF DISCHARGE @ EL 1401.1 FT :

$$Q \approx (3.7)(93\,FT)(6.1\,FT)^{3/2} \approx 5190\,CFS$$

c) AVERAGE APPROACH CHANNEL VELOCITY ≈ Q/A_a

$$v_a \approx 5190\,CFS / 1005\,FT^2 \approx 5.2\,FPS$$

⇒ AVERAGE APPROACH VELOCITY HEAD = $h_a \approx v_a^2/2g$

$$h_a \approx (5.2)^2/2g \approx 0.42\,FT$$

ASSUMING THAT THE APPROACH CHANNEL ENTRANCE LOSS ≈ $0.1\,h_a$ (REF 4, PG 379) ⇒ 0.04 FT

d) APPROACH CHANNEL FRICTION LOSS = $h_f \approx [v_a n / 1.49 R_h^{2/3}]^2 \times L_c$

WHERE L_c = AVERAGE APPROACH CHANNEL LENGTH ≈ 150 FT;
n = MANNING'S ROUGHNESS COEFFICIENT ≈ 0.06 (REF 7, PG 112; EXCAVATED CHANNEL, COBBLE BOTTOM AND LARGE BRUSH AND TREES ON LEFT SIDESLOPE);
R_h = HYDRAULIC RADIUS = FLOW AREA/WETTED PERIMETER: FLOW AREA = $A_a \approx 1005\,FT^2$, RIGHT APPROACH WALL IS ABOUT 8.1 FT HIGH ⇒ PARTIAL WETTED PERIMETER ≈ 8.1 FT, LEFT APPROACH WALL IS AT LEAST 13 FT HIGH ON ABOUT A 1H TO 1V SLOPE ⇒ PARTIAL WETTED PERIMETER ≈ 11.5 FT ⇒ TOTAL WETTED PERIMETER ≈ 120FT + 8.1 FT + 11.5 FT ≈ 139.6

SUBJECT DAM SAFETY INSPECTION
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THEREFORE, $R_h \approx 1005\,FT^2 / 139.6\,FT \approx 7.2\,FT$

$\therefore h_f \approx 150\,FT \times \left[(5.2)(0.06) / (1.49)(7.2)^{2/3} \right]^2 \approx 0.47\,FT$

$\therefore$ TOTAL APPROACH CHANNEL LOSS $\approx 0.04\,FT + 0.47\,FT \approx 0.51\,FT$

$\Rightarrow$ ACTUAL EFFECTIVE HEAD $\approx 6.1\,FT - 0.51\,FT \approx 5.59\,FT$

- CHECK FOR SUBMERGENCE EFFECTS :

DISCHARGE W/O SUBMERGENCE $\Rightarrow Q \approx (3.7)(93\,FT)(5.59)^{3/2}$
$Q \approx 4550\,CFS$

$\therefore$ TAILWATER ON THE SPILLWAY @ $Q \approx 4550\,CFS$ IS APPROXIMATELY @ EL 1397.1 (SHEET 10)

SINCE THE RESERVOIR LEVEL @ $Q \approx 4550\,CFS$ IS APPROXIMATELY @ EL 1401.1 FT $\Rightarrow h_d \approx 1401.1 - 1397.1 \approx 4.0\,FT$ (h_d = DIFFERENCE BETWEEN RESERVOIR AND TAILWATER LEVELS)

$\therefore h_d / H_e \approx 4.0 / 5.59 \approx 0.72$

$\Rightarrow$ CORRECTION TO DISCHARGE COEFFICIENT ≈ 1.0 ($= C_s / C$); ASSUMING THAT THE SUBMERGENCE RELATIONSHIP FOR AN OGEE-SHAPED WEIR IS REPRESENTATIVE FOR THIS TRAPEZOIDAL-SHAPED WEIR (REF 4, PG 342)

$\therefore C_s \approx (1.0)(3.7) \approx 3.7$

$\Rightarrow$ SPILLWAY CAPACITY = $Q \approx (3.7)(93\,FT)(5.59\,FT)^{3/2}$
$\approx 4550\,CFS$

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

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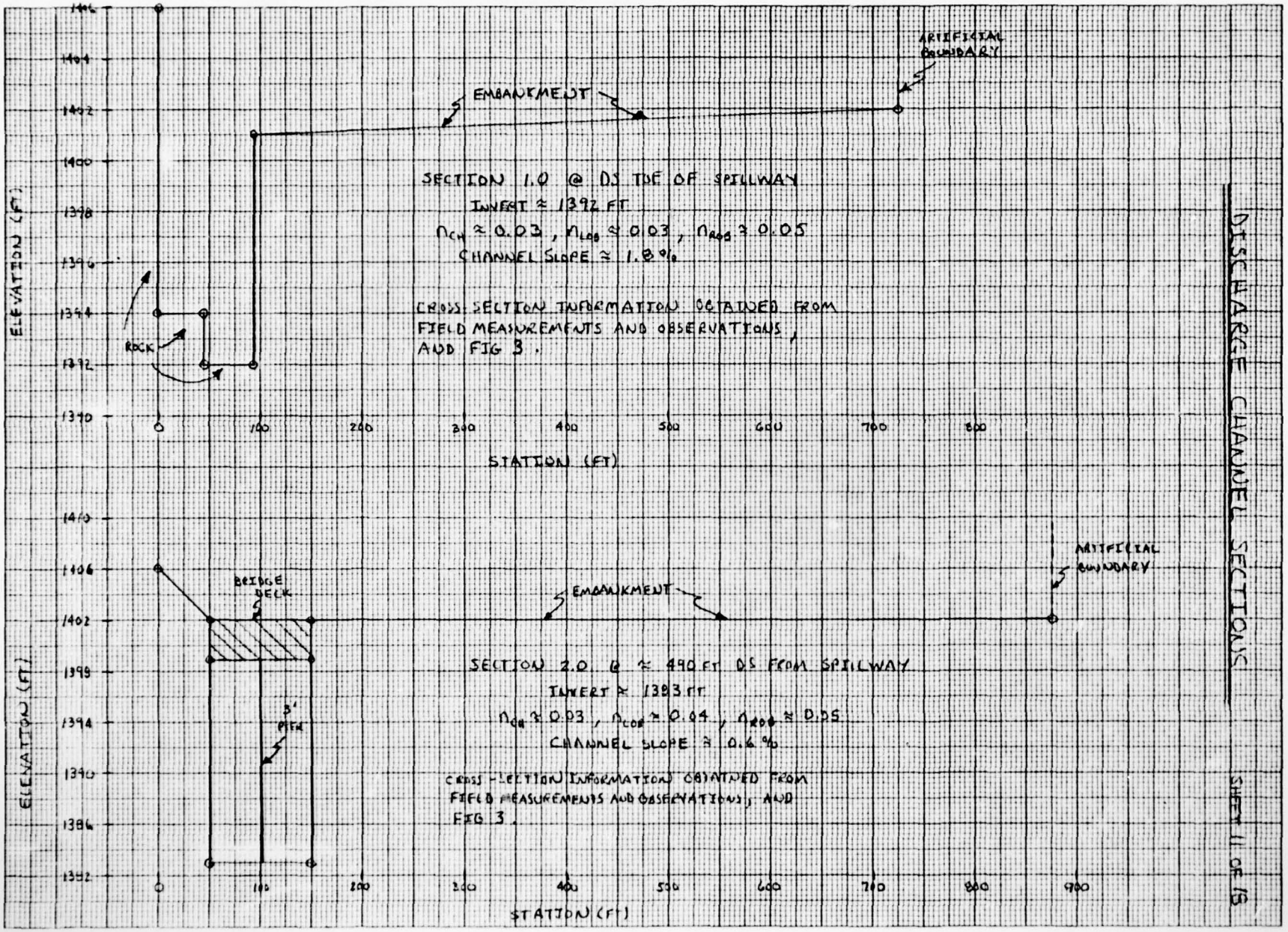
TAILWATER RATING CURVE

DUE TO THE HEIGHT OF THE SPILLWAY CREST ABOVE THE DISCHARGE CHANNEL (ONLY BETWEEN 1 AND 3 FT), AND TO THE AVERAGE GRADIENT OF THE DISCHARGE CHANNEL (≈ 1%), A BACKWATER CURVE WAS COMPUTED TO ASCERTAIN THE EFFECTS OF TAILWATER ON SPILLWAY DISCHARGES. THE BACKWATER CURVE WAS CALCULATED VIA THE HEC-2 WATER SURFACE PROFILE COMPUTER PROGRAM*. HEC-2 COMPUTES BACKWATER BY THE STANDARD STEP METHOD (REF 7, PG 274-290), BASED ON CHANNEL CROSS-SECTION INFORMATION. THE SPECIFIC CROSS-SECTION DATA USED IS GIVEN ON SHEETS 11 TO 13. THE COMPUTATIONS WERE INITIATED AT AN APPARENT CONTROL SECTION, LOCATED ABOUT 1760 FT DOWNSTREAM FROM THE SPILLWAY (@ THE 60-FT FALLS LOCATION), BY THE ASSUMPTION OF CRITICAL DEPTH. CALCULATIONS THEN PROCEEDED UPSTREAM THROUGH A BRIDGE AND FINALLY TO THE TOE OF THE SPILLWAY WEIR. THE RATING TABLE BELOW CORRESPONDS TO THE HEC-2 OUTPUT FOR SECTION 1 @ THE TOE OF THE SPILLWAY WEIR (SEE SUMMARY INPUT/OUTPUT SHEET

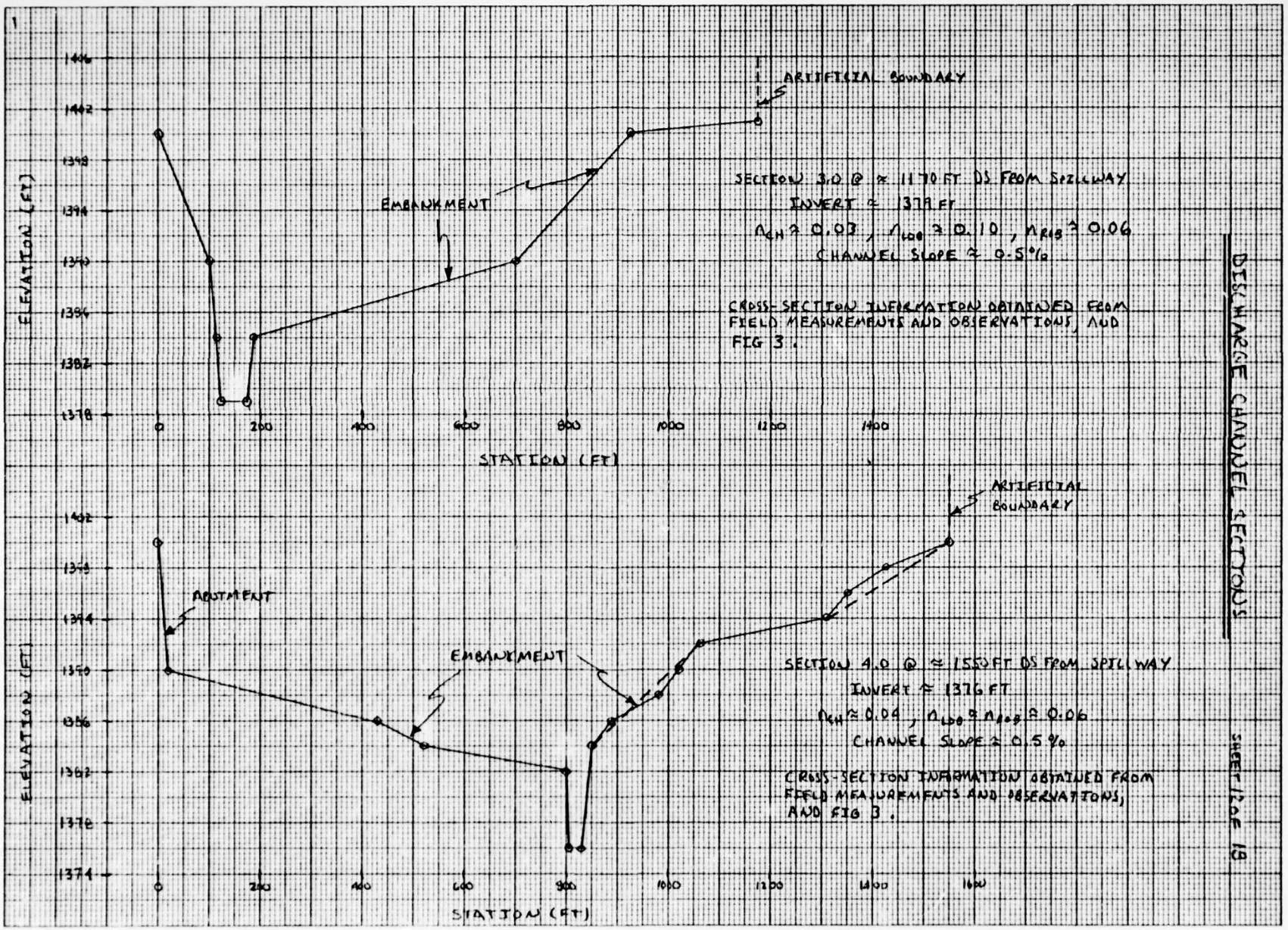
ELEVATION (FT)	Q (CFS)	ELEVATION (FT)	Q (CFS)
1392.0	0	1398.1	6200
1393.7	600	1398.4	6700
1395.1	1700	1398.7	7300
1396.0	2800	1399.3	8400
1396.7	3900	1403.6	14500
1397.1	4500	1404.6	20500
1397.4	5000	1405.3	26500
1397.9	5600		

* HEC-2 WATER SURFACE PROFILES (USER'S MANUAL), HYDROLOGIC ENGINEERING CENTER, US ARMY CORPS OF ENGINEERS, DAVIS, CALIFORNIA, NOV. 1976.



DISCHARGE CHANNEL SECTIONS

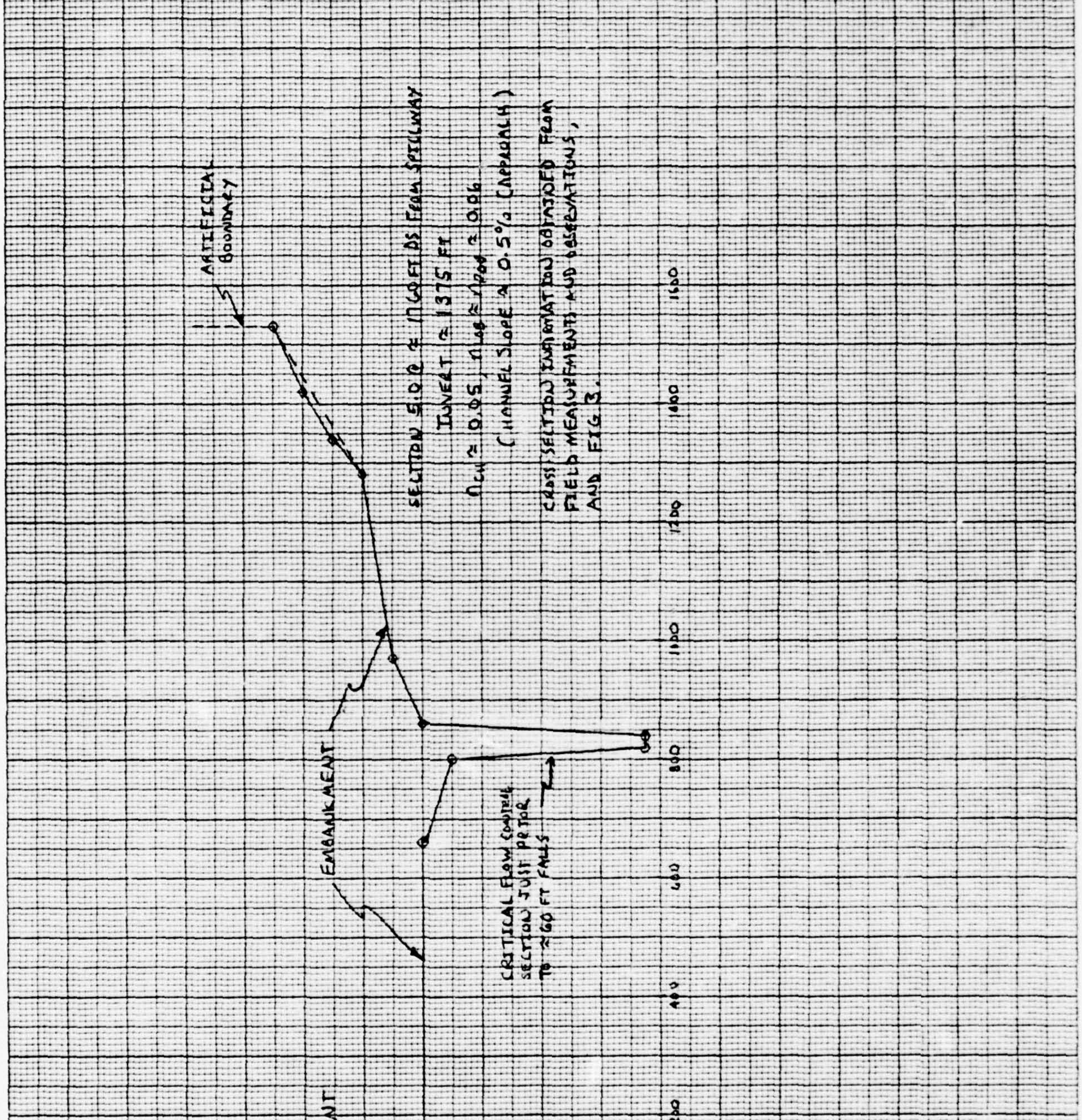
SHEET 11 OF 15



DISCHARGE CHANNEL SECTIONS

SHEET 12 OF 19

DISCHARGE CHANNEL SECTIONS



0 Millimeters to the Centimeter

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

BY WJV DATE 9-7-79 PROJ. NO. 78-617-430

CHKD. BY DJS DATE 9-7-79 SHEET NO. 14 OF 19

gai CONSULTANTS, INC
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SPILLWAY RATING CURVE

AS THE HEAD ABOVE THE WEIR BECOMES SMALL, THE ROUGHNESS OF THE CREST AND THE CONTACT PRESSURE BETWEEN THE WATER AND THE CREST EXERT A LARGER INFLUENCE ON DISCHARGES. THAT IS, THE C-VALUES DECREASE WITH DECREASING HEAD. THE OPPOSITE TREND OCCURS FOR HIGHER HEADS. THEREFORE, ASSUME THAT THE DISCHARGE COEFFICIENT - HEAD RELATIONSHIP FOR THE TRAPEZOIDAL-SHAPED WEIR CAN BE REPRESENTED BY THAT FOR AN OGEE-SHAPED WEIR (REF 4, PG 378, FIG 250). THE MAXIMUM HEAD PRIOR TO OVERTOPPING OF THE EMBANKMENT IS ABOUT 6.1 FT, WHICH WILL BE ASSUMED TO BE THE DESIGN HEAD (H_o). THE DESIGN DISCHARGE COEFFICIENT (C_o) WILL BE ASSUMED TO EQUAL 3.7 (SHEET 7).

ALL DISCHARGES OVER THE WEIR ARE DEFINED BY THE $Q = CLH^{3/2}$ RELATIONSHIP AS GIVEN ON SHEET 7. THE HEAD OVER THE WEIR WILL BE ADJUSTED TO ACCOUNT FOR APPROACH CHANNEL LOSSES BY PROPORTIONING THE COMPUTED LOSS OF 0.51 FT @ EL 1401.1 FT. ALSO, SUBMERGENCE EFFECTS WILL BE CONSIDERED ACCORDING TO THE TAILWATER RATING TABLE ON SHEET 10.

SPILLWAY RATING CURVE IS GIVEN ON SHEET 15.

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM

BY WJV DATE 9-7-79 PROJ. NO. 78-617-430

CHKD. BY DJS DATE 9-7-79 SHEET NO. 16 OF 18

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EMBANKMENT RATING CURVE

- LENGTH OF EMBANKMENT SUBMERGED VS RESERVOIR ELEVATION (BASED ON FIELD MEASUREMENTS)

RESERVOIR ELEVATION (FT)	EMBANKMENT LENGTH (FT)
1401.1	0
1401.3	100
1401.4	120
1401.7	370
1401.9	530
1401.9	650
1402.0	700
1402.4	800
1402.8	950
1405.4	890

- SINCE THE EMBANKMENT CREST IS EXTREMELY BROAD (MINIMUM OF 360FT), FLOWS OVER THE CREST WILL BE ASSUMED TO BE OPEN-CHANNEL TYPE FLOWS, DEFINED BY MANNING'S EQUATION:

$$Q = {}^{1.49}/_{n}\, A\, R_h^{2/3}\, S^{1/2} \qquad \text{(REF 7, PG 129)}$$

WHERE Q = DISCHARGE OVER THE DAM EMBANKMENT, IN CFS;
n = MANNINGS ROUGHNESS FACTOR ≈ 0.05 (FROM EXPERIENCE);
A = TOTAL FLOW AREA, IN FT^2;
R_h = HYDRAULIC RADIUS (SEE SHEET 8);
S ≈ SLOPE OF EMBANKMENT CREST ≈ 0.004 FT/FT (FIELD MEASURED)

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BY WJV DATE 9-7-79 PROJ. NO. 79-617-430

CHKD. BY JJS DATE 9-7-79 SHEET NO. 17 OF 18

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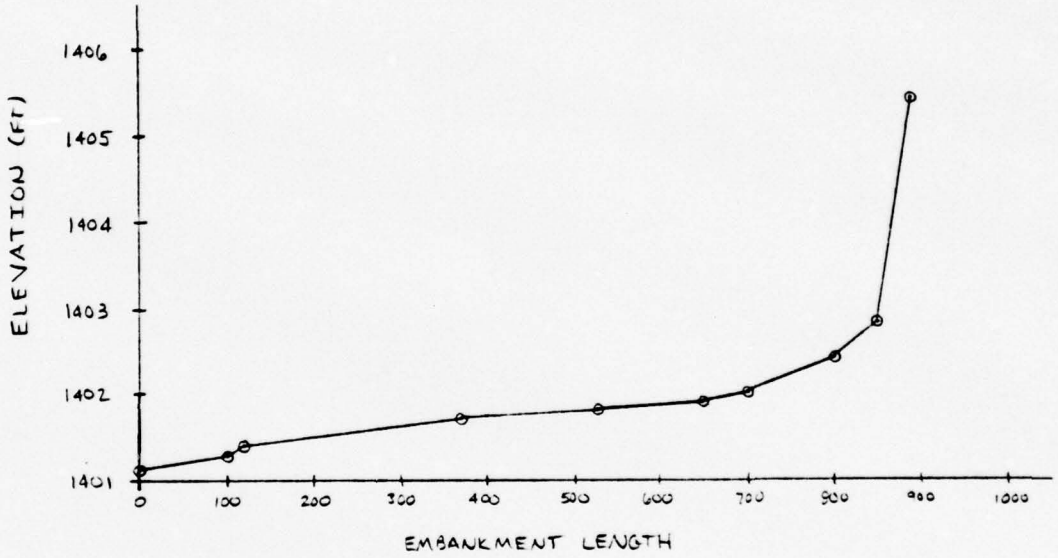
- THE LOW TOP OF DAM ELEVATION IS LOCATED AT THE RIGHT SPILLWAY WINGWALL. ASSUMED EMBANKMENT PROFILE (CORRESPONDING TO THE DATA ON SHEET 16) IS PLOTTED BELOW:



RESERVOIR ELEVATION (FT)	HEIGHT ABOVE LOW EMBANKMENT (FT)	* FLOW AREA A (FT^2)	* HYDRAULIC RADIUS R_h (FT)	$R^{2/3}$	Q (CFS)
1401.1	0	-	-	-	0
1401.3	0.2	10	0.1	0.2	0
1401.4	0.3	21	0.2	0.3	10
1401.7	0.6	95	0.3	0.4	70
1401.9	0.7	140	0.3	0.4	110
1401.9	0.8	199	0.3	0.4	150
1402.0	0.9	266	0.4	0.5	250
1402.4	1.3	566	0.7	0.8	950
1402.8	1.7	996	1.1	1.1	1960
1405.4	4.3	3153	3.5	2.3	13690

* A AND R_h = f (HEIGHT ABOVE LOW EMBANKMENT, AND PLOTTED PROFILE ABOVE)

SUBJECT DAM SAFETY INSPECTION
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TOTAL FACILITY RATING CURVE

TOTAL DISCHARGE = $Q_{SPILLWAY} + Q_{EMBANKMENT}$

	RESERVOIR ELEVATION (FT)	① SPILLWAY Q (CFS)	② EMBANKMENT Q (CFS)	TOTAL Q (CFS)
	1395	0	-	0
	1396	260	-	260
	1397	750	-	750
	1398	1440	-	1440
	1399	2290	-	2290
	1400	3270	-	3270
	1401	4440	-	4440
LOW TOP OF DAM	1401.1	4550	0	4550
	1401.3	* 4790	0	4790
	1401.4	* 4910	10	4920
	1401.7	* 5270	70	5340
	1401.9	* 5390	110	5500
	1401.9	* 5510	150	5660
	1402	5630	250	5990
	1402.4	* 6190	950	7040
	1402.8	* 6750	1860	8610
	1403	7030	** 2300	9330
	1404	8460	** 5500	13960
	1405	9900	** 10700	20600
	1405.4	10510	13690	24200

① FROM SHEET 15

② FROM SHEET 17

* STRAIGHT-LINE INTERPOLATION

** LOG-LOG INTERPOLATION

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM
BY WJV DATE 9-8-79 PROJ. NO. 78-617-430
CHKD. BY DLB DATE 9-14-79 SHEET NO. A OF H

SUMMARY INPUT/OUTPUT SHEETS

BACKWATER CURVE COMPUTATIONS FOR TAILWATER ON SPILLWAY WEIR

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T1 DAM SAFETY INSPECTION - TAILWATER ON SPILLWAY
T2 START CALCULATIONS VIA CRITICAL DEPTH ASSUMPTION @ SECTION 5
T3       HINCKSTON RUN DAM SPILLWAY DISCHARGE CHANNEL
```

J1	ICHECK	INQ	NINV	IDIM	SINT	METRIC	HVINS	Q	WSEL	FQ	
	0.	2.	0.	0.	-1.000000	0.0	0.0	0.	1376.000	0.0	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLOC	IBW	CHWIM	ITHACE	
	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
J3	VARIABLE CODES FOR SUMMARY PRINTOUT										
	34.000	39.000	42.000	43.000	1.000	2.000	3.000	26.000	0.0	0.0	
J5	LFRNT	NUMSEC	********REQUESTED SECTION NUMBERS********								
	-10.000	-10.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NC	0.060	0.060	0.050	0.200	0.400	0.0	0.0	0.0	0.0	0.0	0.0
QT	14.000	600.000	1700.000	2800.000	3900.000	4500.000	5000.000	5600.000	6200.000	6700.000	
QT	7500.000	8400.000	14500.000	20500.000	26500.000	0.0	0.0	0.0	0.0	0.0	
X1	5.000	10.000	800.000	860.000	0.0	0.0	0.0	0.0	0.0	0.0	
GR	1400.000	0.0	1390.000	20.000	1390.000	660.000	1388.000	800.000	1375.000	820.000	
GR	1375.000	840.000	1390.000	860.000	1392.000	970.000	1394.000	1280.000	1400.000	1530.000	
NC	0.060	0.060	0.040	0.200	0.400	0.0	0.0	0.0	0.0	0.0	
X1	4.000	11.000	800.000	850.000	210.000	190.000	210.000	0.0	0.0	0.0	
GR	1400.000	0.0	1390.000	20.000	1386.000	430.000	1384.000	520.000	1382.000	800.000	
GR	1376.000	805.000	1376.000	830.000	1384.000	850.000	1392.000	1060.000	1394.000	1310.000	
GR	1400.000	1550.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NC	0.100	0.060	0.030	0.300	0.500	0.0	0.0	0.0	0.0	0.0	
X1	3.000	9.000	115.000	185.000	500.000	380.000	380.000	0.0	0.0	0.0	
GR	1400.000	0.0	1390.000	100.000	1384.000	115.000	1379.000	125.000	1379.000	175.000	
GR	1384.000	185.000	1390.000	700.000	1400.000	925.000	1401.000	1175.000	0.0	0.0	
NC	0.080	0.050	0.030	0.400	0.600	0.0	0.0	0.0	0.0	0.0	
X1	2.200	6.000	50.000	150.000	630.000	400.000	630.000	0.0	0.0	0.0	
GR	1400.000	0.0	1402.000	50.000	1383.000	50.000	1383.000	150.000	1402.000	150.000	
GR	1402.000	875.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NC	0.080	0.050	0.030	0.200	0.400	0.0	0.0	0.0	0.0	0.0	
X1	2.100	0.0	0.0	0.0	50.000	50.000	50.000	0.0	0.0	0.0	
NC	0.080	0.050	0.030	0.200	0.400	0.0	0.0	0.0	0.0	0.0	
[illegible]	[illegible]	[illegible]	1.000	0.0	100.000	0.0	1555.000	0.0	0.0	0.0	

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SUBJECT DAM SAFETY INSPECTION
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X1	2.000	10.000	50.000	150.000	20.000	20.000	20.000	0.0	0.0	0.0
X2	0.0	0.0	1.000	1399.000	1402.000	0.0	0.0	0.0	0.0	0.0
BT	8.000	0.0	1406.000	1406.000	50.000	1402.000	1402.000	50.000	1402.000	1399.000
BT	99.000	1402.000	1399.000	102.000	1402.000	1399.000	150.000	1402.000	1399.000	150.000
BT	1402.000	1402.000	875.000	1402.000	1402.000	0.0	0.0	0.0	0.0	0.0
GR	1406.000	0.0	1402.000	50.000	1383.000	50.000	1383.000	99.000	1399.000	99.000
GR	1399.000	102.000	1383.000	102.000	1383.000	150.000	1402.000	150.000	1402.000	875.000
NC	0.080	0.050	0.030	0.200	0.400	0.0	0.0	0.0	0.0	0.0
X1	1.900	6.000	50.000	150.000	50.000	50.000	50.000	0.0	0.0	0.0
GR	1406.000	0.0	1402.000	50.000	1383.000	50.000	1383.000	150.000	1402.000	150.000
GR	1402.000	875.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.070	0.050	0.030	0.100	0.300	0.0	0.0	0.0	0.0	0.0
X1	1.000	7.000	0.0	93.000	440.000	440.000	440.000	0.0	0.0	0.0
GR	1406.000	0.0	1394.000	0.0	1394.000	45.000	1392.000	45.000	1392.000	93.000
GR	1401.000	93.000	1402.000	725.000	0.0	0.0	0.0	0.0	0.0	0.0
EJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY PRINTOUT

	SECNO	XLCH	ELMIN	Q	CWSEL	CRIWS	EG	VCH
SECTION @ ≈1760 FT DS FROM SPILLWAY @ CONTROL SECTION	5.000	0.0	1375.00	600.00	1377.83	1377.83	1379.04	8.82
	5.000	0.0	1375.00	1700.00	1380.30	1380.30	1382.40	11.62
	5.000	0.0	1375.00	2800.00	1382.08	1382.08	1384.76	13.10
	5.000	0.0	1375.00	3900.00	1383.52	1383.52	1386.65	14.20
	5.000	0.0	1375.00	4500.00	1384.25	1384.25	1387.57	14.61
	5.000	0.0	1375.00	5000.00	1384.78	1384.78	1388.28	15.02
	5.000	0.0	1375.00	5600.00	1385.39	1385.39	1389.09	15.44
	5.000	0.0	1375.00	6200.00	1385.99	1385.99	1389.85	15.76
	5.000	0.0	1375.00	6700.00	1386.50	1386.50	1390.45	15.96
	5.000	0.0	1375.00	7300.00	1387.17	1387.17	1391.15	16.01
	5.000	0.0	1375.00	8400.00	1391.00	1391.00	1392.11	9.56
	5.000	0.0	1375.00	14500.00	1392.03	1392.03	1393.28	11.42
	5.000	0.0	1375.00	20500.00	1392.83	1392.83	1394.11	12.40
	5.000	0.0	1375.00	26500.00	1393.40	1393.40	1394.80	13.48
SECTION @ ≈ 1550 FT DS FROM SPILLWAY	4.000	210.00	1376.00	600.00	1380.30	0.0	1380.59	4.34
	4.000	210.00	1376.00	1700.00	1383.48	0.0	1383.92	5.53
	4.000	210.00	1376.00	2800.00	1385.63	0.0	1385.81	4.28
	4.000	210.00	1376.00	3900.00	1387.47	0.0	1387.57	3.48
	4.000	210.00	1376.00	4500.00	1388.38	0.0	1388.45	3.18
	4.000	210.00	1376.00	5000.00	1389.10	0.0	1389.16	2.98
	4.000	210.00	1376.00	5600.00	1389.93	0.0	1389.98	2.78
	4.000	210.00	1376.00	6200.00	1390.70	0.0	1390.74	2.60
	4.000	210.00	1376.00	6700.00	1391.31	0.0	1391.35	2.49
	4.000	210.00	1376.00	7300.00	1392.00	0.0	1392.03	2.39
	4.000	210.00	1376.00	8400.00	1392.38	0.0	1392.42	2.57
	4.000	210.00	1376.00	14500.00	1393.60	0.0	1393.67	3.62
	4.000	210.00	1376.00	20500.00	1394.44	0.0	1394.55	4.49
	4.000	210.00	1376.00	26500.00	1395.16	0.0	1395.31	5.24

SUBJECT DAM SAFETY INSPECTION
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	SECNO	XLCH	ELMIN	Q	CWSEL	CRIWS	EG	VCH
SECTION @ ≈ 1170 FT DS FROM SPILLWAY	3.000	380.00	1379.00	600.00	1381.39	0.0	1381.72	4.58
	3.000	380.00	1379.00	1700.00	1384.24	0.0	1384.58	5.37
	3.000	380.00	1379.00	2800.00	1385.91	0.0	1386.46	6.13
	3.000	380.00	1379.00	3900.00	1387.56	0.0	1388.03	5.96
	3.000	380.00	1379.00	4500.00	1388.43	0.0	1388.83	5.73
	3.000	380.00	1379.00	5000.00	1389.13	0.0	1389.46	5.52
	3.000	380.00	1379.00	5600.00	1389.94	0.0	1390.24	5.28
	3.000	380.00	1379.00	6200.00	1390.71	0.0	1390.96	4.95
	3.000	380.00	1379.00	6700.00	1391.32	0.0	1391.53	4.74
	3.000	380.00	1379.00	7300.00	1392.01	0.0	1392.19	4.55
	3.000	380.00	1379.00	8400.00	1392.39	0.0	1392.59	4.91
	3.000	380.00	1379.00	14500.00	1393.61	0.0	1394.00	6.98
	3.000	380.00	1379.00	20500.00	1394.44	0.0	1395.04	8.78
	3.000	380.00	1379.00	26500.00	1395.15	0.0	1395.94	10.34
SECTION @ ≈ 540 FT DS FROM SPILLWAY (@ ≈ 50 FT DS FROM BRIDGE)	2.200	630.00	1383.00	600.00	1384.24	1384.03	1384.60	4.84
	2.200	630.00	1383.00	1700.00	1385.76	0.0	1386.35	6.16
	2.200	630.00	1383.00	2800.00	1387.11	0.0	1387.83	6.81
	2.200	630.00	1383.00	3900.00	1388.34	0.0	1389.17	7.30
	2.200	630.00	1383.00	4500.00	1389.01	0.0	1389.88	7.49
	2.200	630.00	1383.00	5000.00	1389.57	0.0	1390.47	7.61
	2.200	630.00	1383.00	5600.00	1390.25	0.0	1391.18	7.73
	2.200	630.00	1383.00	6200.00	1390.89	0.0	1391.85	7.87
	2.200	630.00	1383.00	6700.00	1391.42	0.0	1392.40	7.96
	2.200	630.00	1383.00	7300.00	1392.03	0.0	1393.05	8.08
	2.200	630.00	1383.00	8400.00	1392.37	0.0	1393.62	8.96
	2.200	630.00	1383.00	14500.00	1393.29	0.0	1396.37	14.08
	2.200	630.00	1383.00	20500.00	1393.93	1393.93	1399.39	18.75
	2.200	630.00	1383.00	26500.00	1395.92	1395.92	1402.45	20.51
SECTION @ ≈ 490 FT DS FROM SPILLWAY (@ DS FACE OF BRIDGE)	2.100	50.00	1383.00	600.00	1384.65	0.0	1384.85	3.64
	2.100	50.00	1383.00	1700.00	1386.00	0.0	1386.55	5.52
	2.100	50.00	1383.00	2800.00	1387.35	0.0	1387.99	6.44
	2.100	50.00	1383.00	3900.00	1388.53	0.0	1389.30	7.05
	2.100	50.00	1383.00	4500.00	1389.18	0.0	1390.00	7.28
	2.100	50.00	1383.00	5000.00	1389.73	0.0	1390.59	7.43
	2.100	50.00	1383.00	5600.00	1390.39	0.0	1391.28	7.58
	2.100	50.00	1383.00	6200.00	1391.03	0.0	1391.95	7.72
	2.100	50.00	1383.00	6700.00	1391.54	0.0	1392.50	7.84
	2.100	50.00	1383.00	7300.00	1392.15	0.0	1393.14	7.98
	2.100	50.00	1383.00	8400.00	1392.52	0.0	1393.73	8.82
	2.100	50.00	1383.00	14500.00	1393.90	0.0	1396.65	13.31
	2.100	50.00	1383.00	20500.00	1396.39	1393.89	1400.03	15.31
	2.100	50.00	1383.00	26500.00	1398.78	1395.94	1403.16	16.79

SUBJECT: DAM SAFETY INSPECTION
HINCKSTON RUN DAM

BY: WJV DATE: 9-8-79 PROJ. NO.: 78-617-430

CHKD. BY: DLB DATE: 9-14-79 SHEET NO.: D OF H

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Section	SECNO	XLCH	ELMIN	Q	CWSEL	CRIWS	EG	VCH
SECTION @ ≈ 470 FT DS FROM SPILLWAY (@ US FACE OF BRIDGE)	2.000	20.00	1383.00	600.00	1384.71	0.0	1384.91	3.62
	2.000	20.00	1383.00	1700.00	1386.13	0.0	1386.62	5.59
	2.000	20.00	1383.00	2800.00	1387.39	0.0	1388.06	6.58
	2.000	20.00	1383.00	3900.00	1388.56	0.0	1389.37	7.23
	2.000	20.00	1383.00	4500.00	1389.20	0.0	1390.07	7.48
	2.000	20.00	1383.00	5000.00	1389.75	0.0	1390.66	7.65
	2.000	20.00	1383.00	5600.00	1390.40	0.0	1391.35	7.81
	2.000	20.00	1383.00	6200.00	1391.03	0.0	1392.02	7.96
	2.000	20.00	1383.00	6700.00	1391.55	0.0	1392.56	8.08
	2.000	20.00	1383.00	7300.00	1392.15	0.0	1393.20	8.22
	2.000	20.00	1383.00	8400.00	1392.52	0.0	1393.80	9.10
	2.000	20.00	1383.00	14500.00	1393.88	0.0	1396.81	13.72
	2.000	20.00	1383.00	20500.00	1397.33	0.0	1400.71	14.74
	2.000	20.00	1383.00	26500.00	1399.10	0.0	1403.57	16.98
SECTION @ ≈ 420 FT DS FROM SPILLWAY (@ ≈ 50 FT US FROM BRIDGE)	1.900	50.00	1383.00	600.00	1384.88	0.0	1385.04	3.20
	1.900	50.00	1383.00	1700.00	1386.38	0.0	1386.77	5.03
	1.900	50.00	1383.00	2800.00	1387.64	0.0	1388.21	6.03
	1.900	50.00	1383.00	3900.00	1388.82	0.0	1389.51	6.70
	1.900	50.00	1383.00	4500.00	1389.45	0.0	1390.21	6.97
	1.900	50.00	1383.00	5000.00	1389.99	0.0	1390.79	7.15
	1.900	50.00	1383.00	5600.00	1390.64	0.0	1391.47	7.33
	1.900	50.00	1383.00	6200.00	1391.27	0.0	1392.14	7.50
	1.900	50.00	1383.00	6700.00	1391.78	0.0	1392.68	7.63
	1.900	50.00	1383.00	7300.00	1392.36	0.0	1393.32	7.79
	1.900	50.00	1383.00	8400.00	1392.80	0.0	1393.94	8.57
	1.900	50.00	1383.00	14500.00	1394.75	0.0	1397.12	12.34
	1.900	50.00	1383.00	20500.00	1398.15	0.0	1401.00	13.53
	1.900	50.00	1383.00	26500.00	1400.31	0.0	1403.95	15.31
SECTION @ TOE OF SPILLWAY	1.000	440.00	1392.00	600.00	1393.69	1393.69	1394.54	7.41
	1.000	440.00	1392.00	1700.00	1395.13	1395.13	1396.24	8.45
	1.000	440.00	1392.00	2800.00	1395.99	1395.99	1397.53	9.96
	1.000	440.00	1392.00	3900.00	1396.74	1396.74	1398.66	11.12
	1.000	440.00	1392.00	4500.00	1397.12	1397.12	1399.23	11.66
	1.000	440.00	1392.00	5000.00	1397.42	1397.42	1399.68	12.08
	1.000	440.00	1392.00	5600.00	1397.77	1397.77	1400.21	12.53
	1.000	440.00	1392.00	6200.00	1398.12	1398.12	1400.72	12.93
	1.000	440.00	1392.00	6700.00	1398.40	1398.40	1401.13	13.25
	1.000	440.00	1392.00	7300.00	1398.70	1398.70	1401.61	13.69
	1.000	440.00	1392.00	8400.00	1399.27	1399.27	1402.46	14.33
	1.000	440.00	1392.00	14500.00	1403.61	1403.61	1405.10	11.17
	1.000	440.00	1392.00	20500.00	1404.62	1404.62	1406.27	12.45
	1.000	440.00	1392.00	26500.00	1405.30	1405.30	1407.23	13.93

SUBJECT DAM SAFETY INSPECTION
HINCKSTON RUN DAM
BY WJV DATE 9-8-79 PROJ. NO. 78-617-420
CHKD. BY DLB DATE 9-14-79 SHEET NO. E OF H

GAI CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

DAM SAFETY INSPECTION
HINCKSTON RUN DAM ****** OVERTOPPING ANALYSIS ******
15-MINUTE TIME STEP AND 48-HOUR STORM DURATION

JOB SPECIFICATION

NO	NMIN	DTMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
240	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIOS 1
RTIOS= .20 .30 .40 .50 1.00

****

SUB-AREA RUNOFF COMPUTATION

INFLOW INTO HINCKSTON RUN DAM RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	10.00	0.00	10.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	102.00	120.00	130.00	140.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .802

INITIAL AND CONSTANT RAINFALL LOSSES AS PER COE

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 4.54 CP= .45 NTA= 0

BASE FLOW PARAMETERS AS PER COE

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=18.66 AND R=28.78 INTERVALS

1

SUBJECT DAM SAFETY INSPECTION
HUNTSTON POND DAM
BY WJV DATE 9-8-79 PROJ. NO. 78-617-430
CHKD. BY DLB DATE 9-14-79 SHEET NO. F OF H

Engineers • Geologists • Planners
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UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 4.54 HOURS, CP= .45 VOL= .96

0.	31.	94.	164.	250.	339.	453.	589.	728.	828.
885.	937.	982.	1020.	1052.	1077.	1094.	1101.	1095.	1076.
1051.	1021.	989.	958.	928.	899.	870.	842.	814.	787.
761.	735.	710.	686.	663.	641.	619.	598.	578.	559.
525.	509.	494.	479.	464.	450.	436.	423.	410.	398.
230.	222.	215.	207.	200.	193.	187.	180.	174.	168.
163.	157.	152.	147.	142.	137.	132.	128.	123.	119.
115.	111.	107.	104.	100.	97.	93.	90.	87.	84.
81.	78.	76.	73.	71.	68.	66.	64.	61.	59.
57.	55.	53.	52.	50.	48.	47.	45.	43.	42.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.95	24.53	2.42	646680.
										(684.)(623.)(61.)(18311.94)			

RESERVOIR INFLOW HYDROGRAPHS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12805.	11286.	6065.	2245.	646635.
CMS	363.	320.	172.	64.	18311.
INCHES		9.90	21.29	23.64	23.64
MM		251.57	540.73	600.58	600.58
AC-FT		5596.	12029.	13360.	13360.
THOUS CU M		6903.	14837.	16480.	16480.

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3842.	3386.	1819.	674.	193991.
CMS	109.	96.	52.	19.	5493.
INCHES		2.97	6.39	7.09	7.09
MM		75.47	162.22	180.17	180.17
AC-FT		1679.	3609.	4008.	4008.
THOUS CU M		2071.	4451.	4944.	4944.

0.4 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5122.	4514.	2426.	898.	258654.
CMS	145.	128.	69.	25.	7324.
INCHES		3.96	8.52	9.46	9.46
MM		100.63	216.29	240.23	240.23
AC-FT		2239.	4812.	5344.	5344.
THOUS CU M		2761.	5935.	6592.	6592.

HYDROGRAPH ROUTING

ROUTE INFLOW THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

SUBJECT DAM SAFETY INSPECTION
HUCKSTON RUN DAM

BY WJV DATE 9-13-79 PROJ. NO. 78-617-420

CHKD. BY DLR DATE 9-14-79 SHEET NO. G OF H

Engineers • Geologists • Planners
Environmental Specialists

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	3340.	-1

STAGE	1395.00	1396.00	1397.00	1398.00	1399.00	1400.00	1401.00	1401.10	1401.30
	1401.70	1401.80	1401.90	1402.00	1402.40	1402.80	1403.00	1404.00	1405.00
FLOW	0.00	260.00	750.00	1440.00	2290.00	3270.00	4440.00	4550.00	4790.00
	5140.00	5500.00	5660.00	5880.00	7040.00	8610.00	9330.00	13960.00	20580.00
CAPACITY=	0.	40.	190.	480.	910.	1480.	2220.	3140.	3340.	3450.
	3560.	3670.	3780.	3890.	4010.	4120.	4240.	4370.	4500.	4630.
ELEVATION=	1393.	1393.	1394.	1395.	1396.	1397.	1398.	1399.	1395.	1396.
	1397.	1398.	1399.	1400.	1401.	1402.	1403.	1404.	1405.	1406.

CREL	SPWID	COOL	EXPW	ELEVL	COOL	CAREA	EXPL
1395.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1401.1	0.0	0.0	0.

RESERVOIR OUTFLOW HYDROGRAPHS

OVERTOPPING OCCURS @ ≈ 0.38 PMF

PEAK OUTFLOW IS 12706. AT TIME 44.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	12706.	11225.	6030.	2229.	642032.	
CMS	360.	318.	171.	63.	18180.	PMF
INCHES		9.85	21.17	23.48	23.48	
MM		250.22	537.67	596.30	596.30	
AC-FT		5566.	11961.	13265.	13265.	
THOUS CU M		6866.	14754.	16362.	16362.	

PEAK OUTFLOW IS 3552. AT TIME 45.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	3552.	3208.	1791.	665.	191642.	
CMS	101.	91.	51.	19.	5427.	
INCHES		2.82	6.29	7.01	7.01	0.3 PMF
MM		71.51	159.68	177.99	177.99	
AC-FT		1591.	3552.	3960.	3960.	
THOUS CU M		1962.	4381.	4884.	4884.	

PEAK OUTFLOW IS 4785. AT TIME 45.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	4785.	4329.	2395.	888.	255651.	
CMS	135.	123.	68.	25.	7245.	
INCHES		3.80	8.41	9.36	9.36	0.4 PMF
MM		96.48	213.56	237.63	237.63	
AC-FT		2146.	4751.	5286.	5286.	
THOUS CU M		2648.	5860.	6520.	6520.	

1

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APPENDIX D

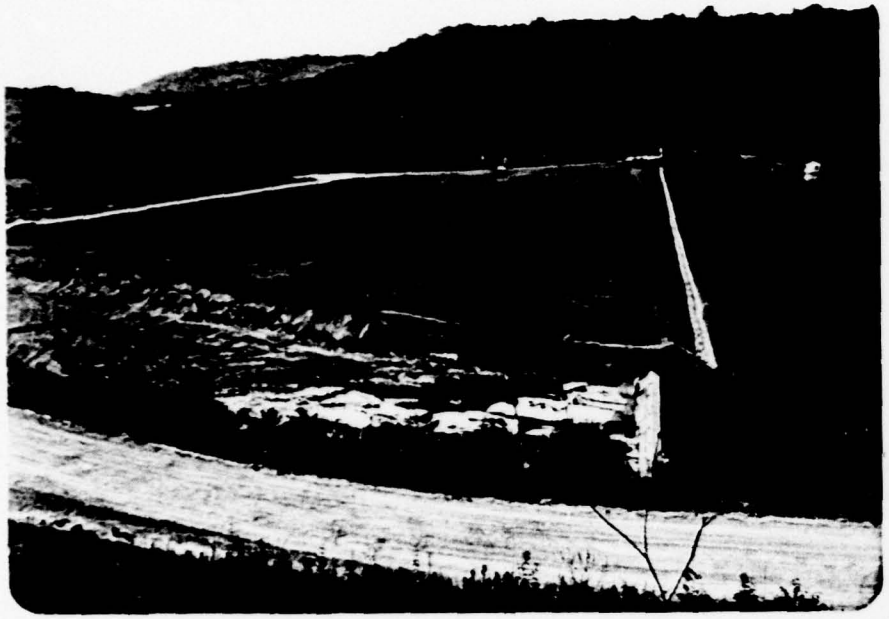
PHOTOGRAPHS

PHOTOGRAPH 1 Overview of Hinckston Run Dam.

Photograph 2 View of reservoir and watershed area.

PHOTOGRAPH 3 View showing upstream riprap and intake tower.

PHOTOGRAPH 4 View taken across Hinckston Run channel approximately 3.5 miles downstream of the dam.



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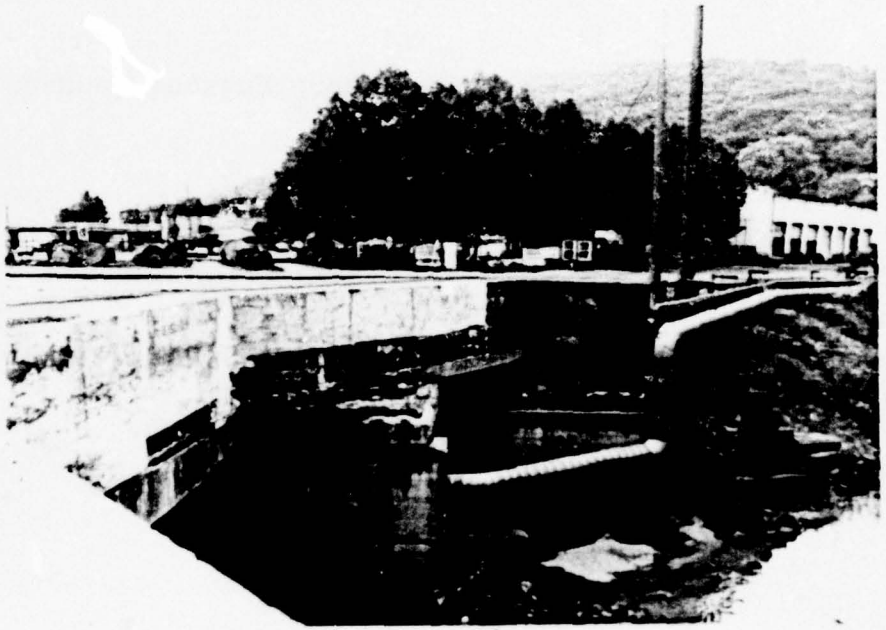

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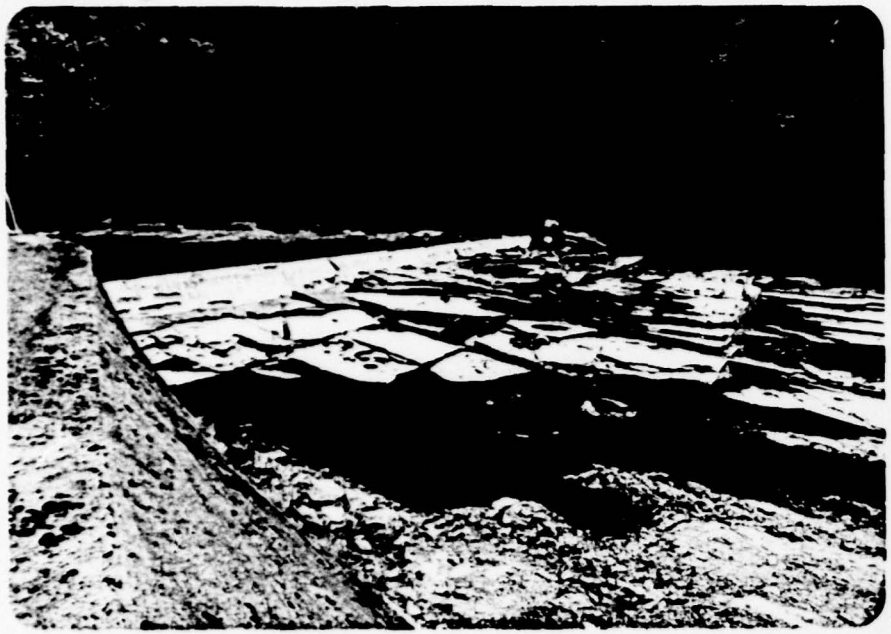
PHOTOGRAPH 5 View showing spillway crest section and immediate downstream channel.

PHOTOGRAPH 6 View from spillway approach channel looking downstream.

PHOTOGRAPH 7 View of plunge pool and overfall cut into hot-poured slag at downstream end of spillway channel.

PHOTOGRAPH 8 View of valve house and adjoining water treatment structure from embankment crest.



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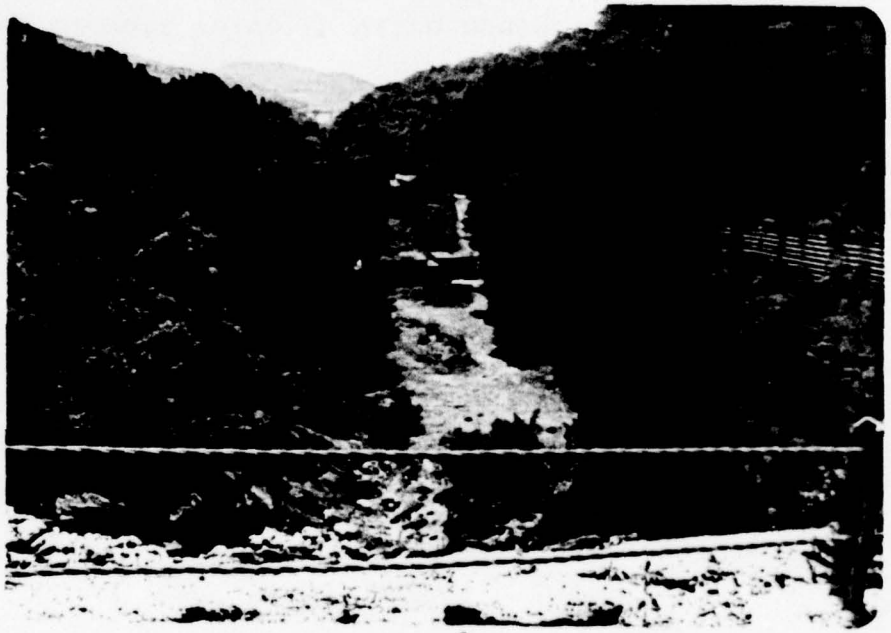
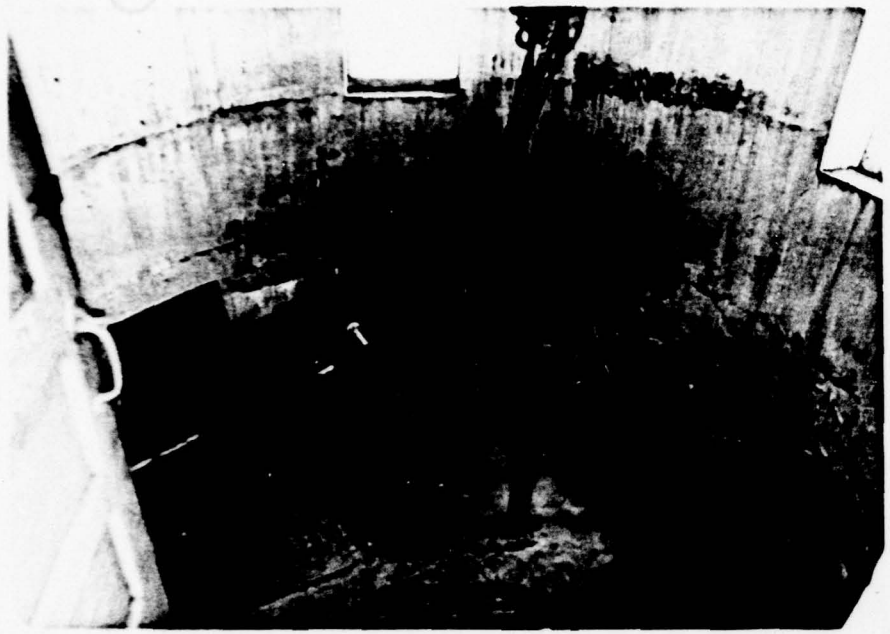


8

PHOTOGRAPH 9 Interior veiw of control tower.

PHOTOGRAPH 10 View of electrically operated blowoff valve in valve house.

PHOTOGRAPH 11 View of blowoff in operation.



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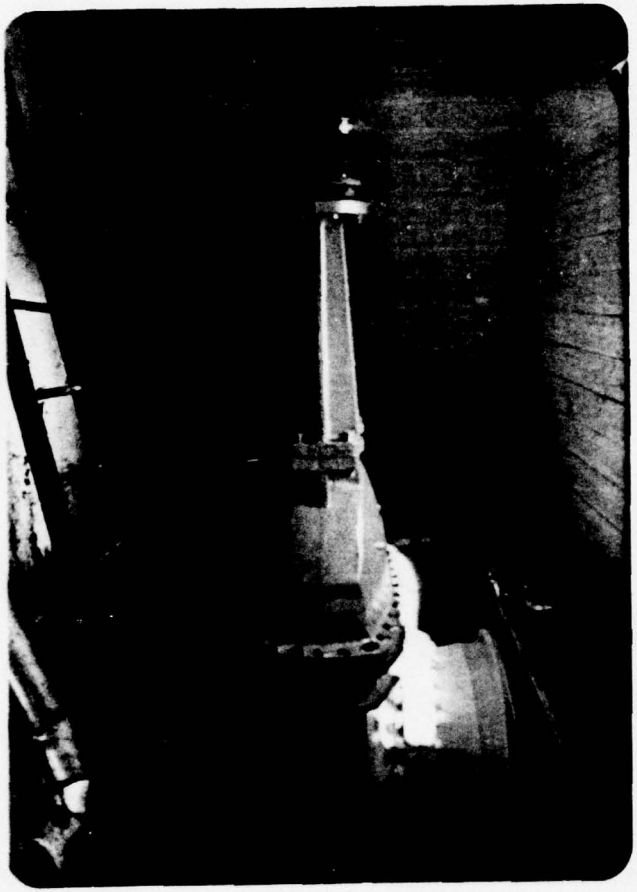

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APPENDIX E

GEOLOGY

Geology

Hinckston Run Dam is located about 1-mile north of the Johnstown corporate boundary in the Allegheny Mountain section of the Appalachian Plateau Province of west-central Pennsylvania. In this area, the Allegheny Mountain section is characterized by gently folded sedimentary rock strata of middle Pennsylvanian age. Major structural axes strike from southwest to northeast with flanking strata dipping northwest and southeast.

Structurally, the dam and reservoir lie immediately east of the axial trace of the Johnstown syncline (see Geology Map). Consequently, bedrock at the dam site dips gently to the northwest or normal to the axial trace of the syncline 100 feet per mile or about 2 degrees. As the dam and reservoir lie nearly on the Johnstown syncline, a secondary dip component to the northeast extends along the direction of plunge. Locally, the secondary dip component is about 80 feet per mile or approximately 1 degree.

The sedimentary rock sequence contained in the abutments immediately and underlying the embankment are members of the Conemaugh Group of Pennsylvanian age. The rocks of this group typically exhibit the rapid

vertical and lateral lithology changes characteristic of cyclic sedimentation. Rock types to be expected include sandstone and shale with minor amounts of clay and coal. Underlying the Conemaugh Group is the Allegheny Group the top of which is indicated by the presence of the Upper Freeport Coal. The top of the Allegheny Group lies about 160 below the embankment. No deep coal mining has occurred beneath the dam and reservoir, however, the Lower Kittanning seam which occurs approximately 400 feet beneath the reservoir has been extensively mined throughout the surrounding area by Bethlehem Mines Corporation.

References

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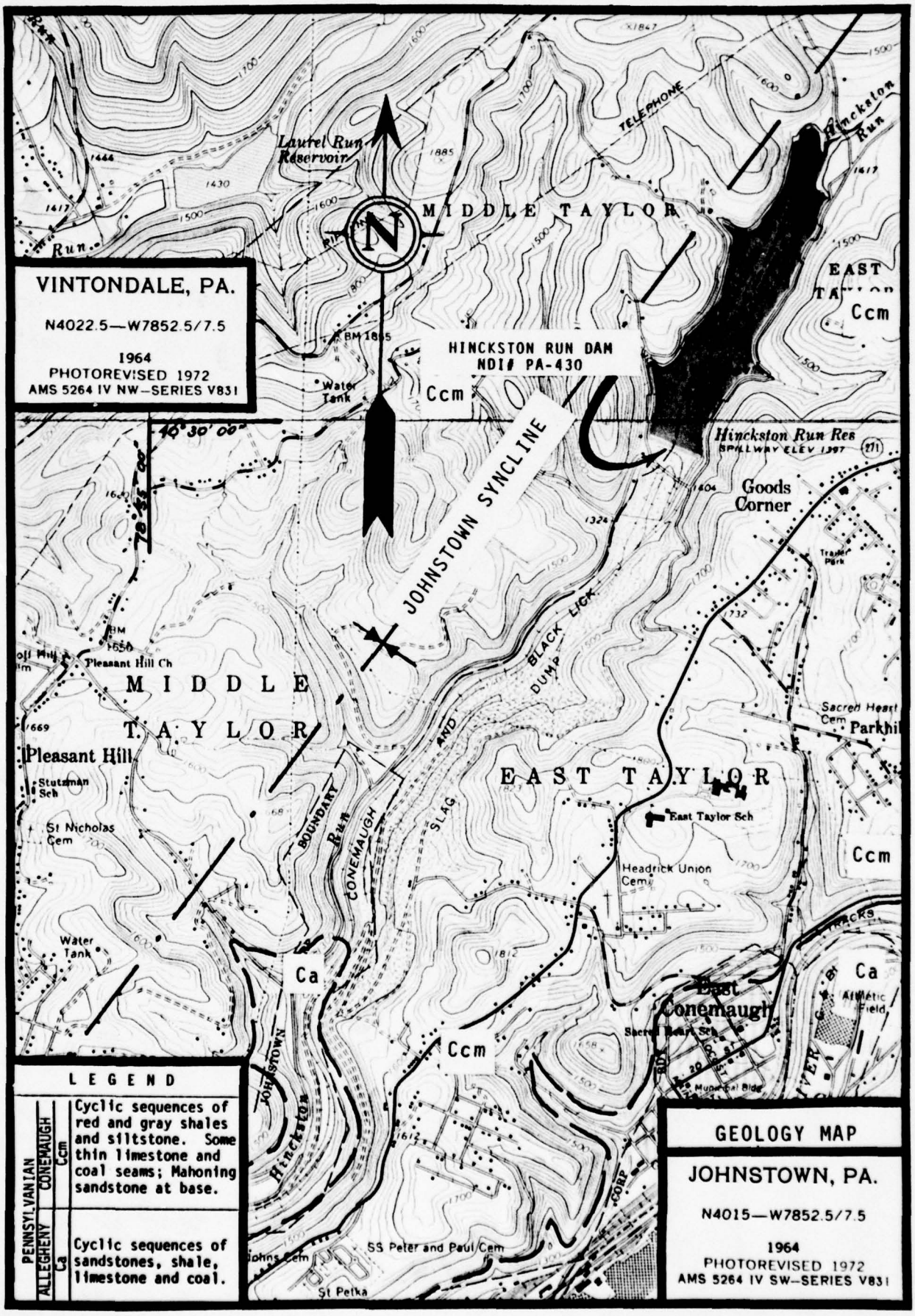

VINTONDALE, PA.
N4022.5—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV NW—SERIES V831
HINCKSTON RUN DAM
NDI# PA-430
JOHNSTOWN SYNCLINE
MIDDLE TAYLOR
EAST TAYLOR
Pleasant Hill
Goods Corner
East Conemaugh
Laurel Run Reservoir
Hinckston Run Res
SPILLWAY ELEV 1397
Pleasant Hill Ch
Stutzman Sch
St Nicholas Cem
East Taylor Sch
Headrick Union Cem
Sacred Heart Sch
SS Peter and Paul Cem
St Petka
Johns Cem
Water Tank
BM 1855
BM 1650
Trailer Park
Athletic Field
Sacred Heart Cem
Parkhill
BLACK LICK
DUMP
AND
SLAG
BOUNDARY
RUN
CONEMAUGH
JOHNSTOWN
Hinckston Run
CORP
TELEPHONE
Ccm
Ca
40°30'00"
78°45'00"
LEGEND
PENNSYLVANIAN
CONEMAUGH
Ccm
Cyclic sequences of red and gray shales and siltstone. Some thin limestone and coal seams; Mahoning sandstone at base.
ALLEGHENY
Ca
Cyclic sequences of sandstones, shale, limestone and coal.
GEOLOGY MAP
JOHNSTOWN, PA.
N4015—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV SW—SERIES V831

APPENDIX F

FIGURES

LIST OF FIGURES

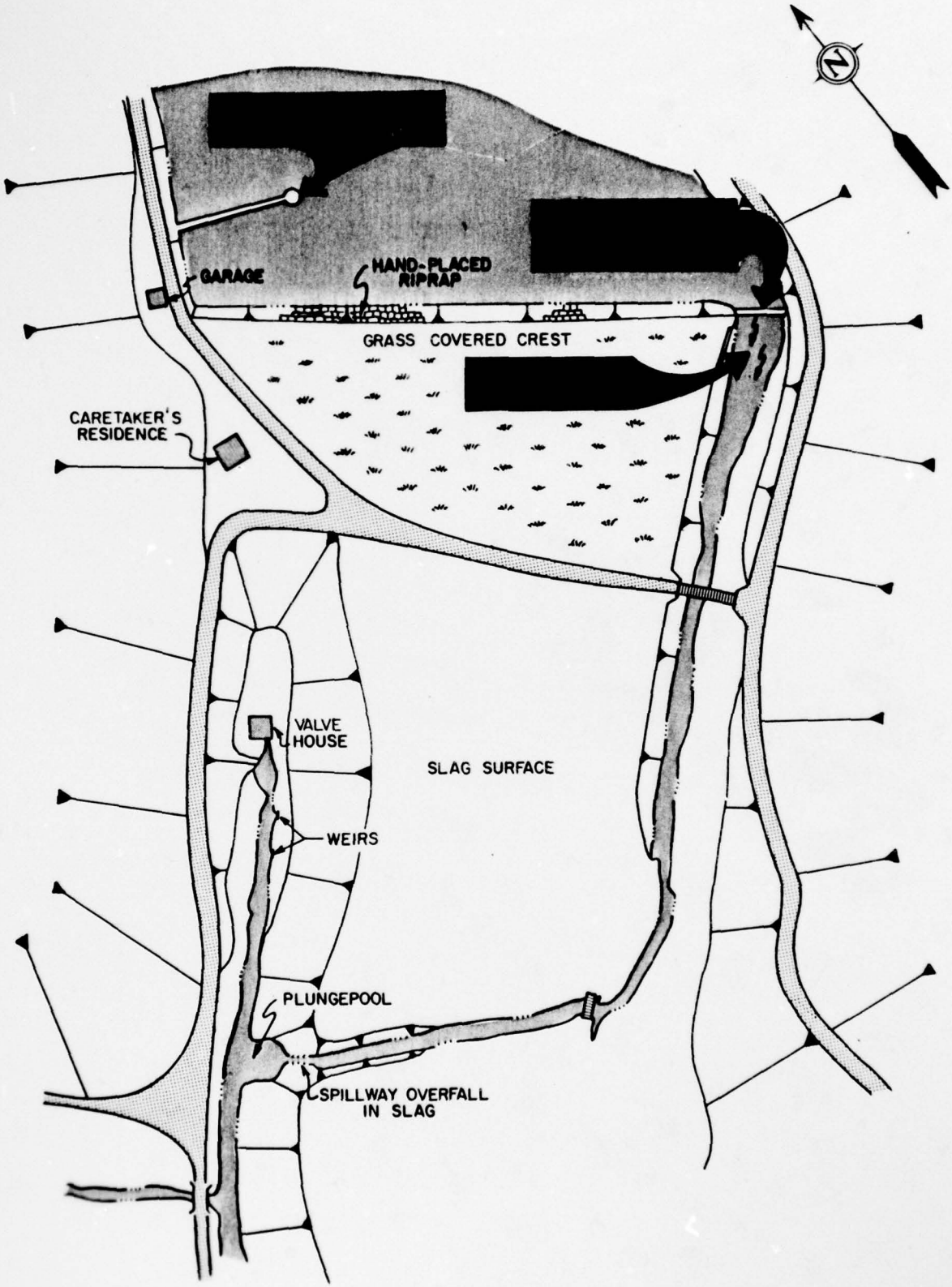
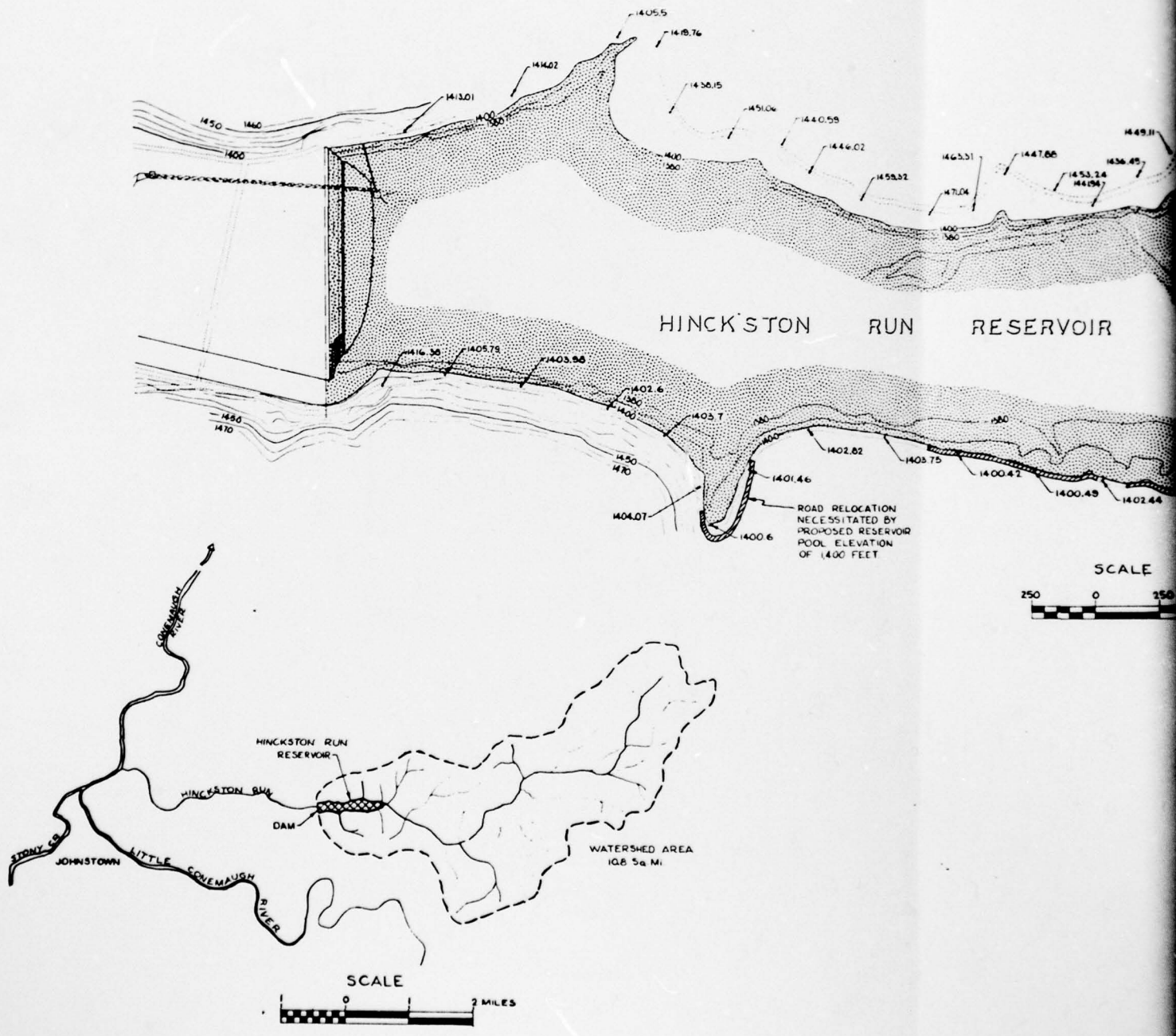


FIGURE 1 – HINCKSTON RUN DAM
GENERAL PLAN
FIELD INSPECTION NOTES


HINCK'STON RUN RESERVOIR
1405.5
1418.76
1414.02
1413.01
1436.15
1451.06
1440.58
1446.02
1459.32
1465.31
1447.88
1449.11
1453.24
1441.94
1436.45
1471.04
1450
1460
1400
1416.38
1405.79
1403.98
1402.6
1403.7
1402.82
1403.75
1400.42
1400.49
1402.44
1401.46
1404.07
1400.6
ROAD RELOCATION NECESSITATED BY PROPOSED RESERVOIR POOL ELEVATION OF 1400 FEET
SCALE
250 0 250

CONEMAUGH RIVER
HINCKSTON RUN RESERVOIR
HINCKSTON RUN
DAM
STONY CR.
JOHNSTOWN
LITTLE CONEMAUGH RIVER
WATERSHED AREA
10.8 Sq Mi
SCALE
0
2 MILES

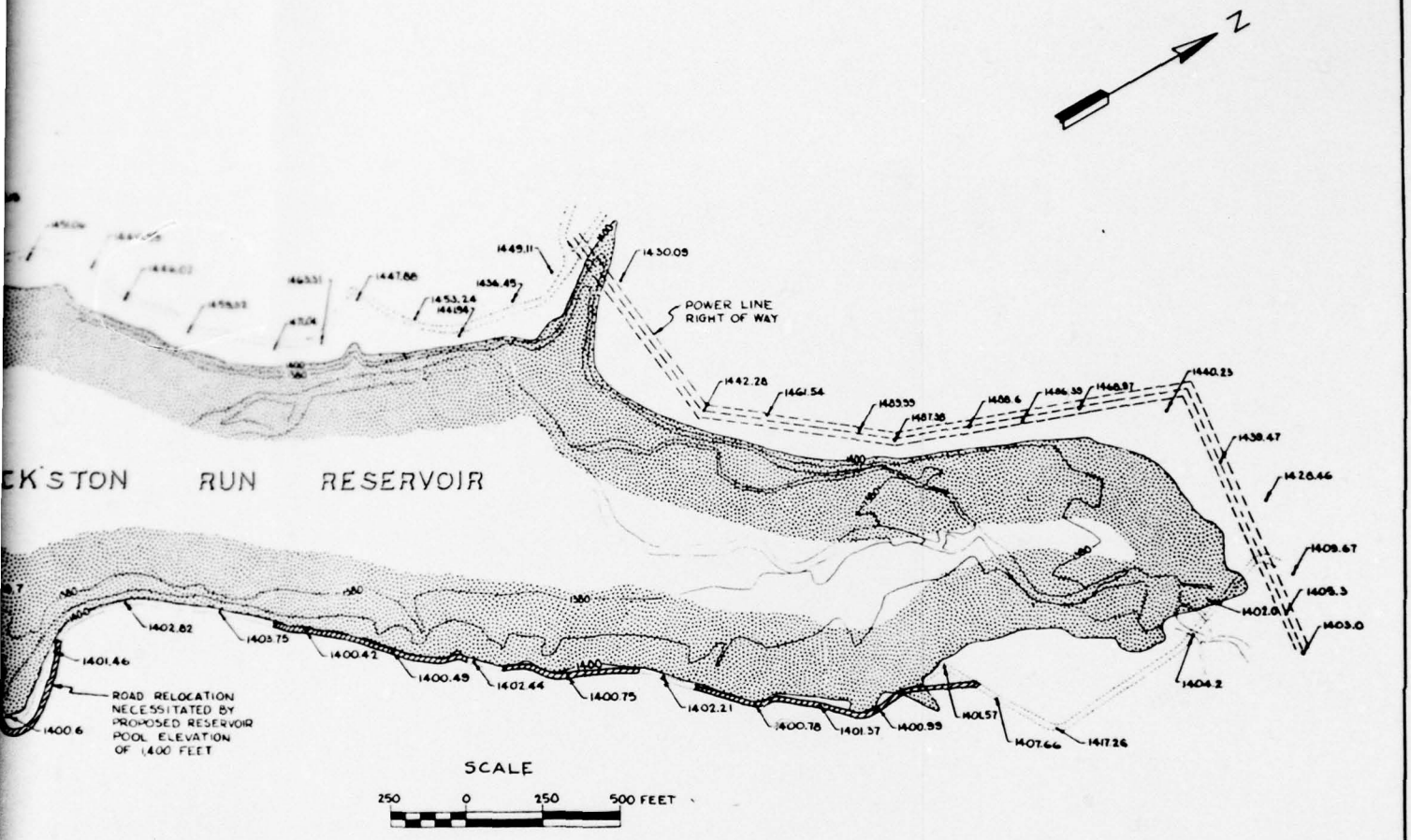


FIGURE 2

BETHLEHEM STEEL COMPANY JOHNSTOWN PLANT	
HINCKSTON RUN DAM LOCATION AND GENERAL PLAN	
HYDROTECHNIC CORPORATION NEW YORK, N. Y.	
DRAWN HJR CHECKED AST	DATE MAY 1958
APPROVED	SCALE AS SHOWN
	JHD-1

THIS MAP PREPARED BY L ROBERT KIMBALL & ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS EBENSBURG, PENNSYLVANIA, BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED MARCH 28, 1977.

TOPOGRAPHIC MAP

OF

RIDERS DUMP AREA

FOR

BETHLEHEM STEEL CORPORATION

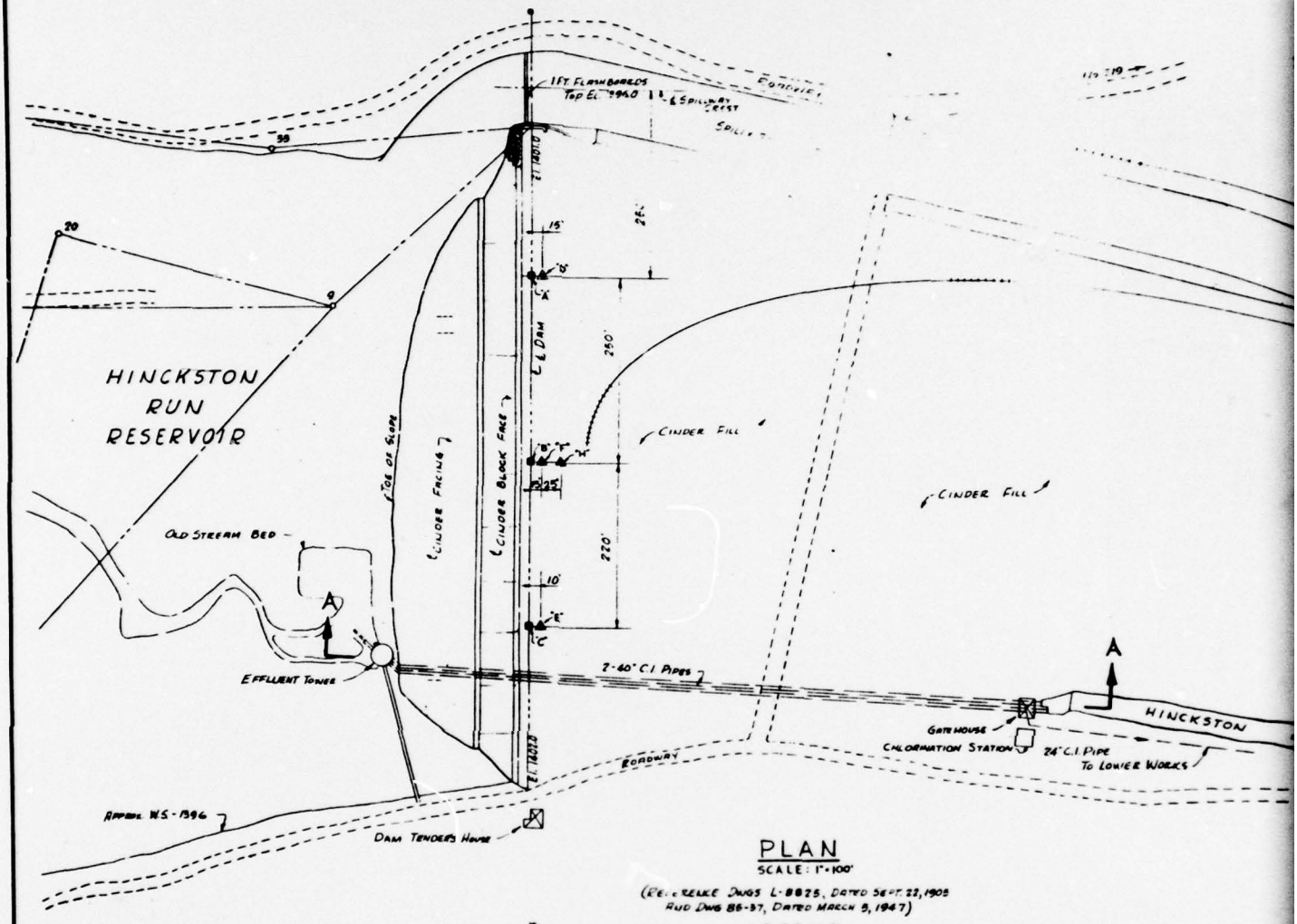
JOHNSTOWN PENNSYLVANIA

SCALE 1"=100' CONTOUR INTERVAL = 2'

JULY, 1977

FIGURE 3

SHEET 1 OF 7



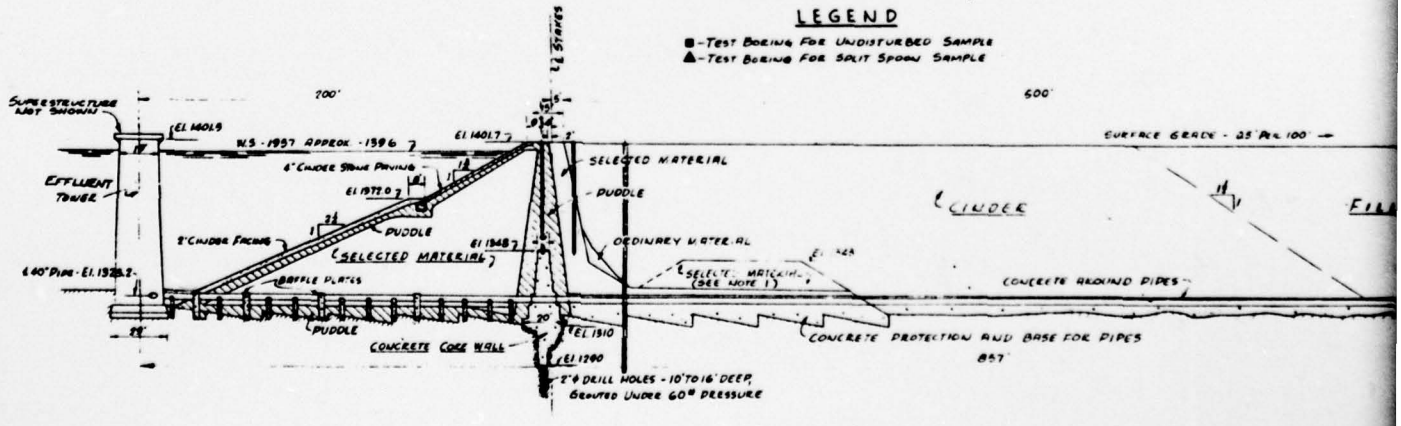
PLAN

SCALE: 1" = 100'

(REFERENCE DWGS L-8875, DATED SEPT. 22, 1905
AND DWG 86-37, DATED MARCH 9, 1967)

LEGEND

■ - TEST BORING FOR UNDISTURBED SAMPLE
▲ - TEST BORING FOR SPLIT SPOON SAMPLE



SECTION A-A

SCALE: 1" = 40'

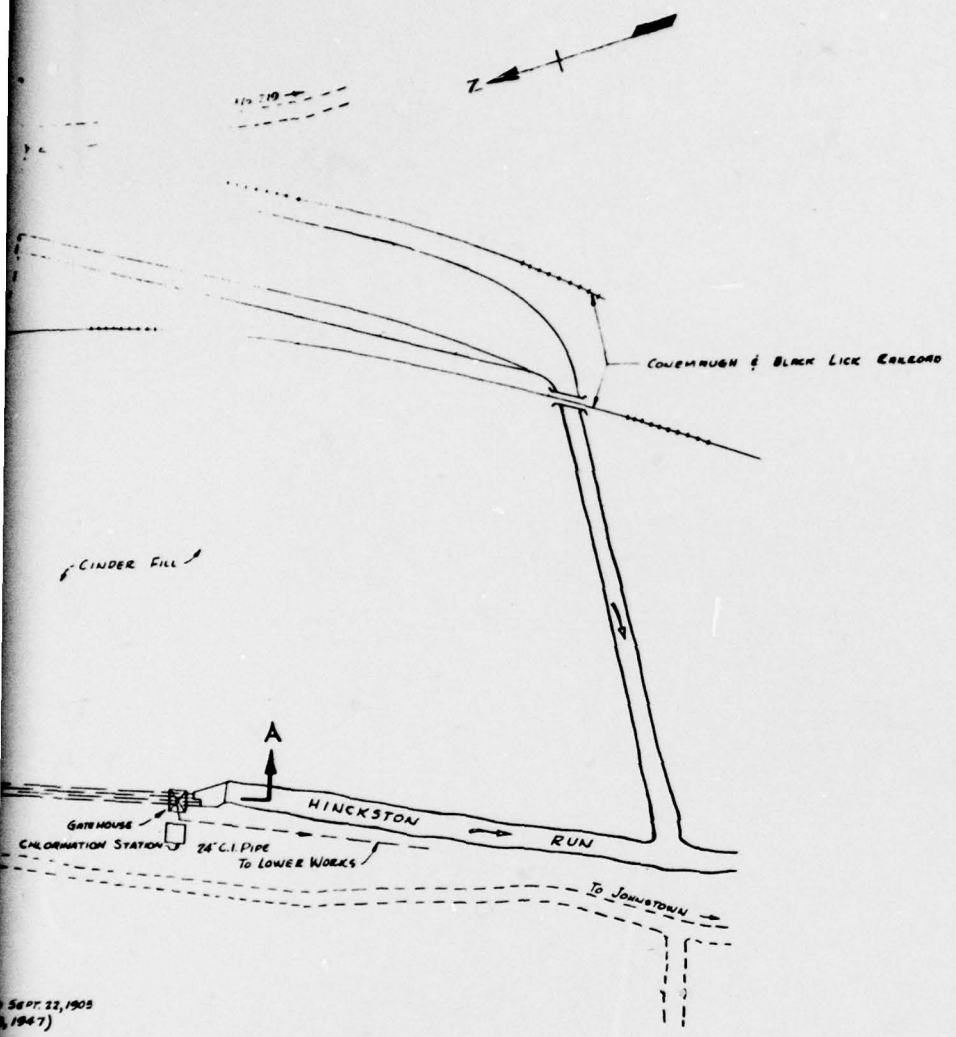
(REFERENCE DWG X-28621, DATED FEB. 12, 1908)

NOTE

1) THIS EMBANKMENT WAS MADE DURING
2) SEE APPENDIX "A" INVESTIGATION.

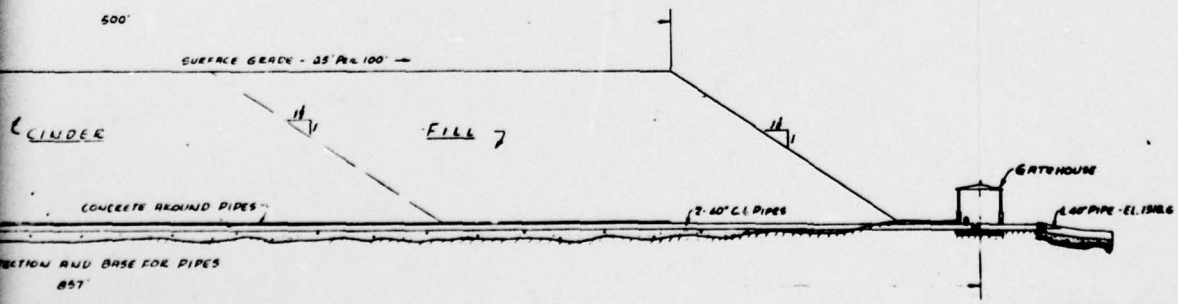
STORAGE CAPACITY

ELEVATION	M.G.
1930	4.6
1935	17.9
1940	41.4
1945	75.3
1950	121.1
1955	178.1
1960	247.6
1965	326.8
1970	418.7
1975	524.8
1980	644.1
1985	776.9
1990	925.0
1992	988.8
1994	1055.1
1996	1123.8
1997	1158.0
1998	1194.9
1600	1268.3
1601	1305.8



SEPT. 22, 1905
, 1947)

SAMPLE
SAMPLE



TION AND BASE FOR PIPES
857'

A-A

ED FEB. 12, 1908)

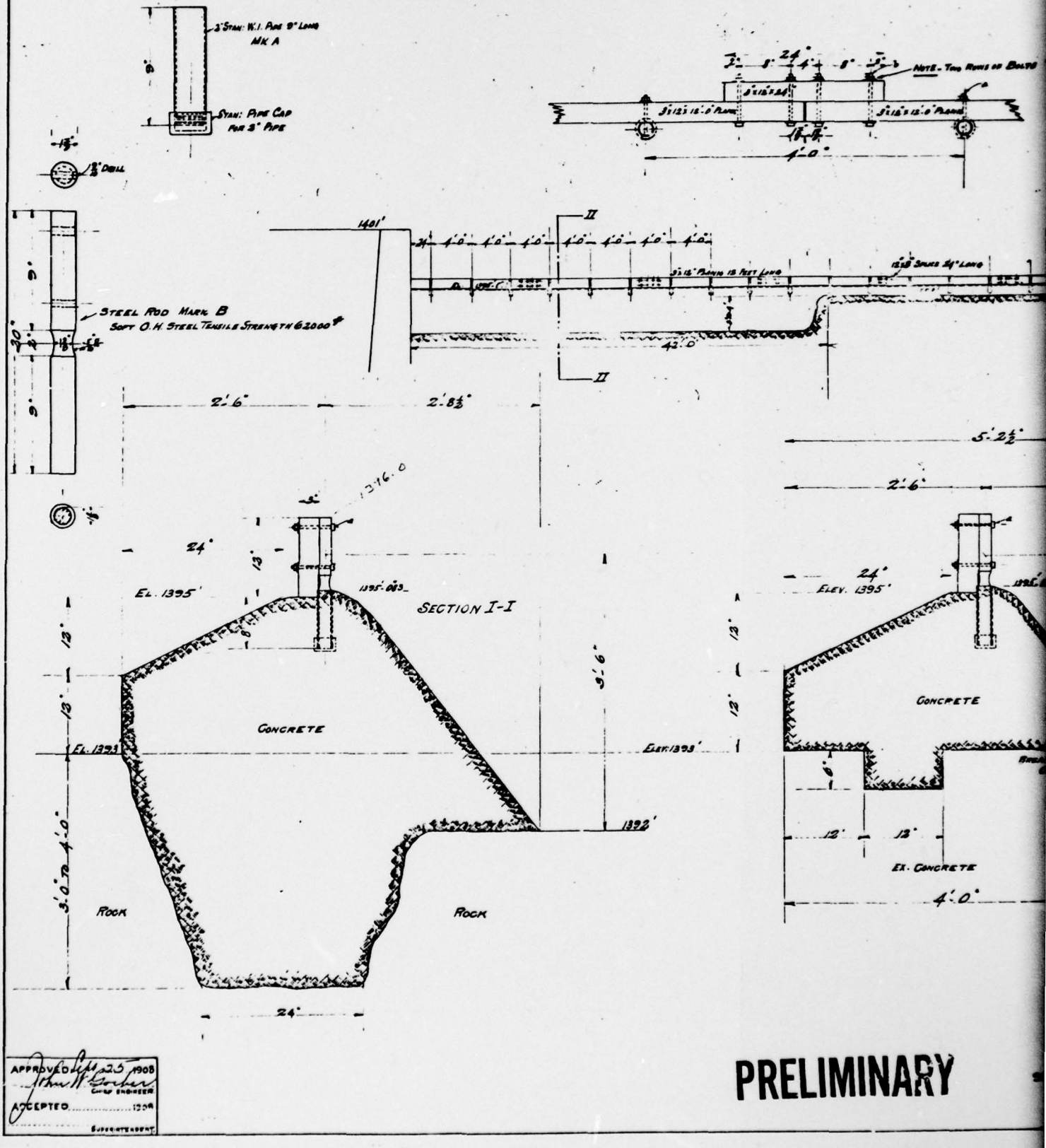
NOTE

1) THIS EMBANKMENT OF SELECTED MATERIAL WAS MADE PRIOR TO ADOPTION OF CINDER.
2) SEE APPENDIX "A" FOR REPORT ON SUB-SOIL INVESTIGATION.

FIGURE 4

BETHLEHEM STEEL COMPANY JOHNSTOWN PLANT	
HINCKSTON RUN DAM PLAN AND PROFILE OF EXISTING DAM LOCATION OF BORE HOLES	
HYDROTECHNIC CORPORATION NEW YORK, N. Y.	
DRAWN BY: BPH CHECKED BY: A.S.T. APPROVED	DATE: MAY 1948 SCALE: AS SHOWN
	JHD-2

M 16489



APPROVED Sept 23 1908
John M Goodell
CHIEF ENGINEER
ACCEPTED 1908
SUPERINTENDENT

PRELIMINARY

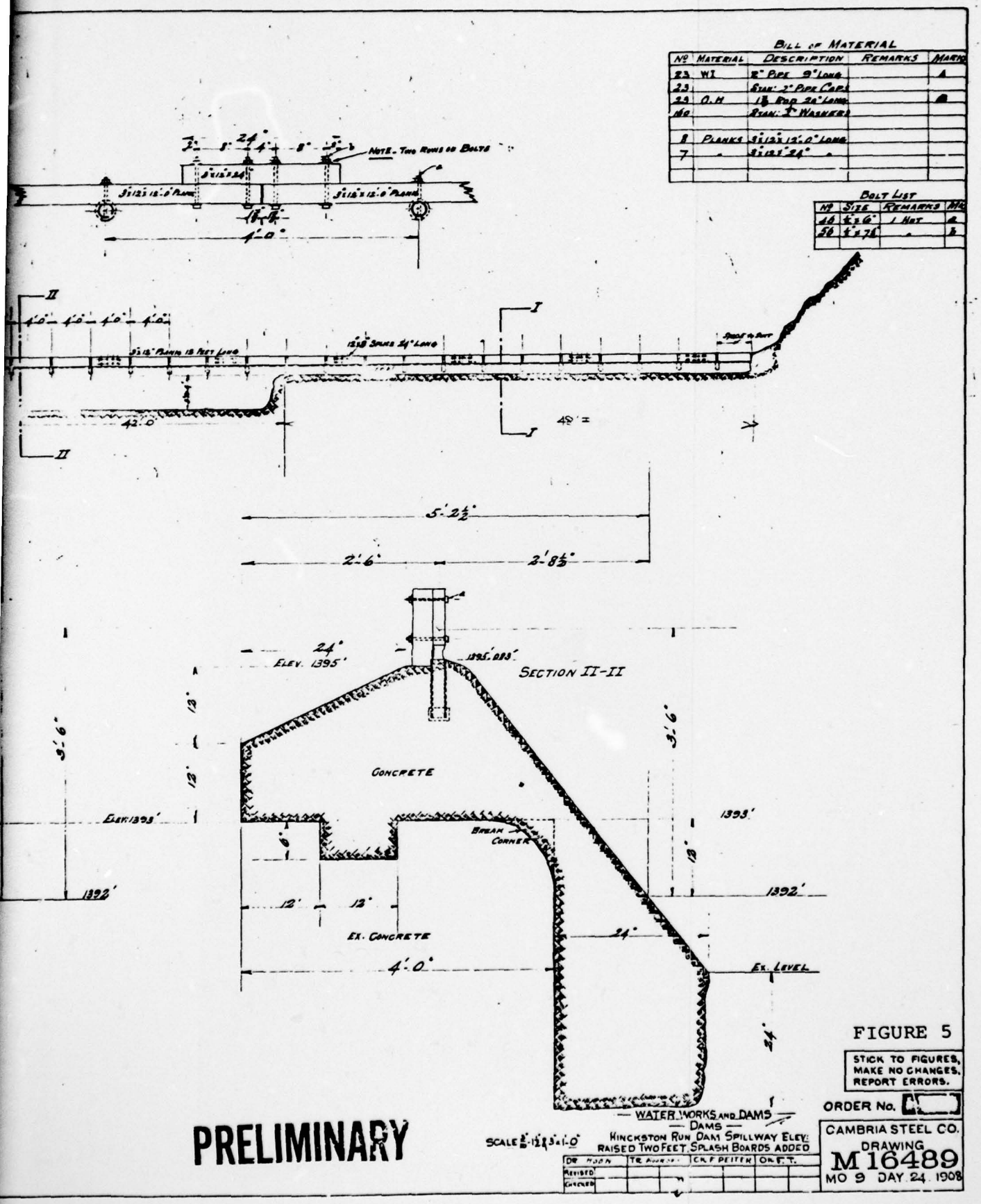


FIGURE 5

STICK TO FIGURES, MAKE NO CHANGES, REPORT ERRORS.

ORDER No.

PRELIMINARY

SCALE 1" = 1'-0"

— WATER WORKS AND DAMS —
— DAMS —
KINCKSTON RUN DAM SPILLWAY ELEV. RAISED TWO FEET, SPLASH BOARDS ADDED

DR. HORN	TR.	CK. F. PEITER	CK. E. T.
REVISED			
CHECKED			

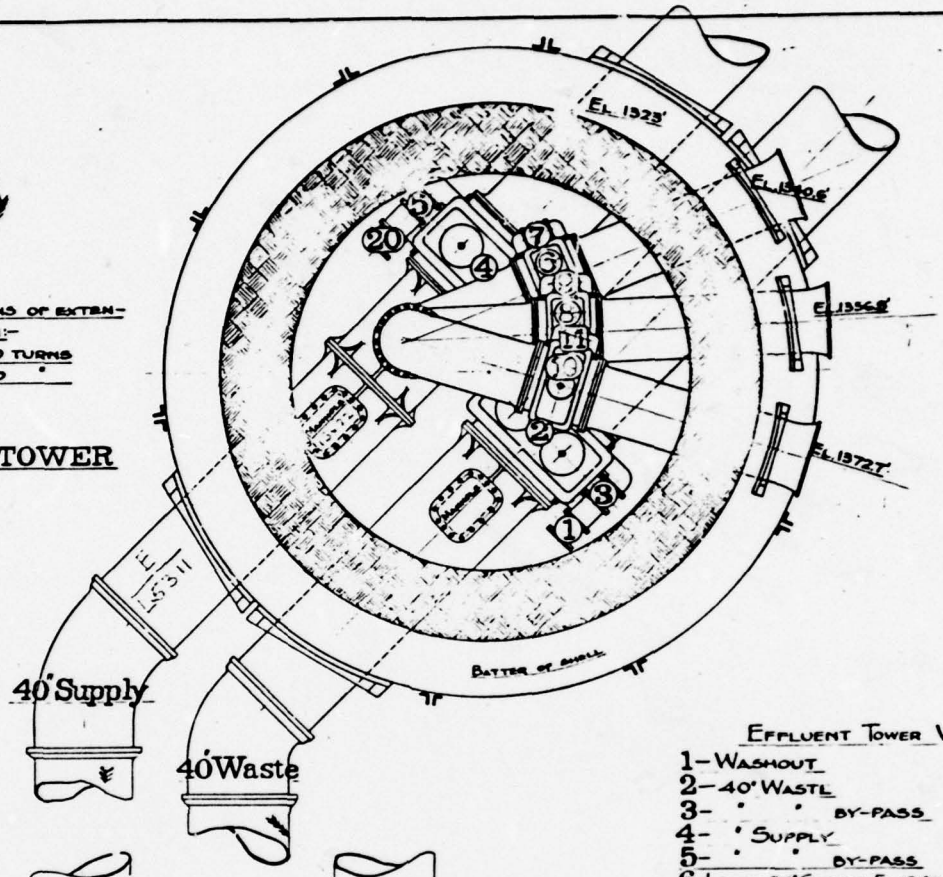
CAMBRIA STEEL CO.
DRAWING
M16489
MO 9 DAY 24 1908

2

TO OPEN ALL VALVES EXCEPT #14-#20

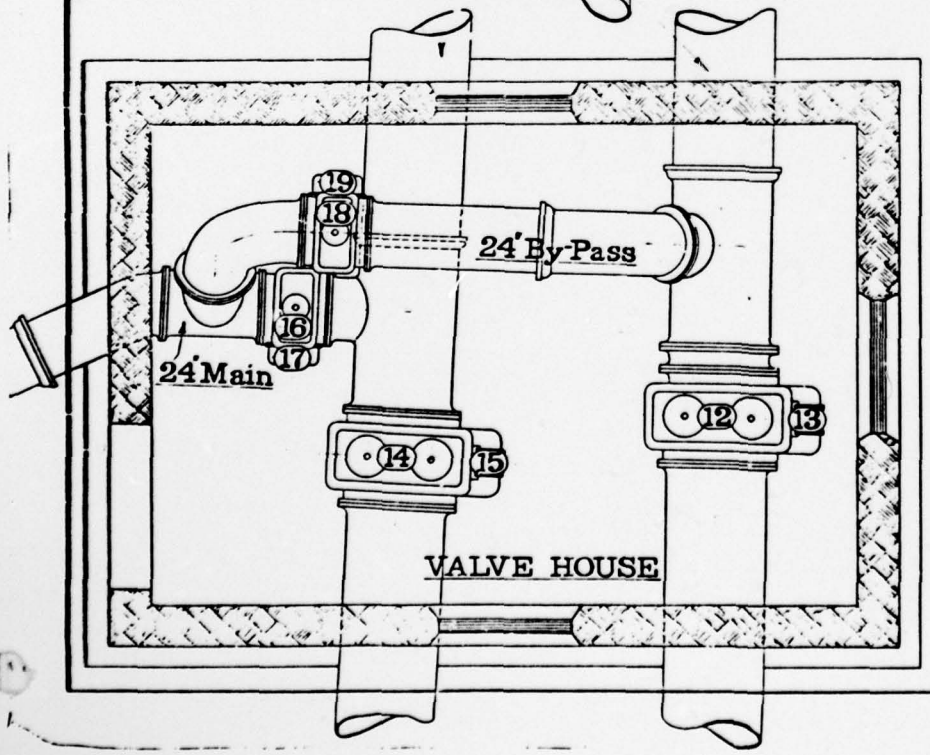
NOTE—
NUMBER OF TURNS OF EXTENSION STEMS TO OPEN:—
40" VALVES — 300 TURNS
24" " — 220 "

EFFLUENT TOWER



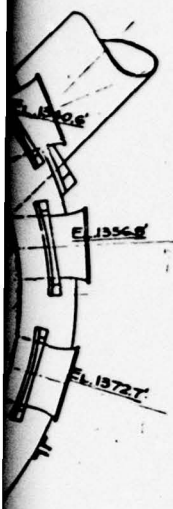
EFFLUENT TOWER VALVES

1—WASHOUT
2—40" WASTE
3— " " BY-PASS
4— " SUPPLY
5— " " BY-PASS
6—LOWER 24" SUPPLY—EL. 1340.6'
7— " " " " BY-PASS
8—MIDDLE " " —EL. 1356.8'
9— " " " " BY-PASS
10—UPPER " " —EL. 1372.7'
11— " " " " BY-PASS
20—WASHOUT



VALVE HOUSE VALVES

12—40" WASTE
13— " " BY-PASS
14— " SUPPLY
15— " " BY-PASS
16— 24" "
17— " " BY-PASS
18—24" BY-PASS FROM 40" WASTE
19— " " " " " BY-PASS



Effluent Tower Valves
Shout
Waste
" By-Pass
Supply
" By-Pass
r 24" Supply-El. 1340.6'
" " " By-Pass
le " " -El. 1356.8'
" " " By-Pass
er " " -El. 1372.7'
" " " By-Pass
Washout

Valve House Valves
40" Waste
" " By-Pass
" Supply
" " By-Pass
24"
" " By-Pass
By-Pass from 40" Waste
" " " By-Pass

Capacity to Crest of Spillway-El. 1395.0'

Depth in Feet	Capacity in 1,000,000 Gallons per foot	Capacity in 1,000,000 Gallons in depth given
4	—	0.9
5	0.9	1.8
6	1.3	3.1
7	1.5	4.6
8	1.9	6.5
9	2.3	8.8
10	2.6	11.4
11	3.1	14.5
12	3.4	17.9
13	3.9	21.8
14	4.2	26.0
15	illegible	illegible
16	5.2	35.9
17	5.5	41.4
18	6.0	47.4
19	6.4	53.8
20	6.8	60.6
21	7.1	67.7
22	7.6	75.3
23	8.1	83.4
24	8.6	92.0
25	9.1	101.1
26	illegible	illegible
27	10.3	121.1
28	10.7	131.8
29	11.2	143.0
30	11.6	154.6
31	12.0	166.6
32	12.5	179.1
33	12.9	192.0
34	13.3	205.3
35	13.7	219.0
36	14.1	233.1
37	14.5	247.6
38	15.0	262.6
39	15.4	278.0
40	15.8	293.8
41	16.2	310.0
42	16.8	326.8
43	17.2	344.0
44	17.8	361.8
45	18.4	380.2
46	18.9	399.1
47	19.6	418.7
48	20.1	438.8
illegible	illegible	459.5
50	21.2	480.7
51	21.7	502.4
52	22.4	524.8
53	22.8	547.6
54	23.4	571.0
illegible	23.8	594.8
illegible	24.4	619.2
illegible	24.9	644.1
59	25.5	669.6
59	illegible	695.6
60	26.5	722.1
61	27.1	749.2
62	27.7	776.9
63	28.3	805.2
64	29.0	834.2
65	29.6	863.8
66	30.3	894.1
67	30.9	925.0
68	31.6	956.6
69	32.2	988.8
70	32.8	1021.6

Capacity to Top of Dam-El 1401.0'

Depth in Feet	Capacity in 1,000,000 Gallons per foot	Capacity in 1,000,000 Gallons in depth given
71	33.5	1055.1
72	34.0	1089.1
73	34.7	1123.8
74	35.2	1159.0
75	35.9	1194.9
76	36.4	1231.3
77	37.0	1268.3
78	37.5	1305.8

PRELIMINARY

See F.-6241

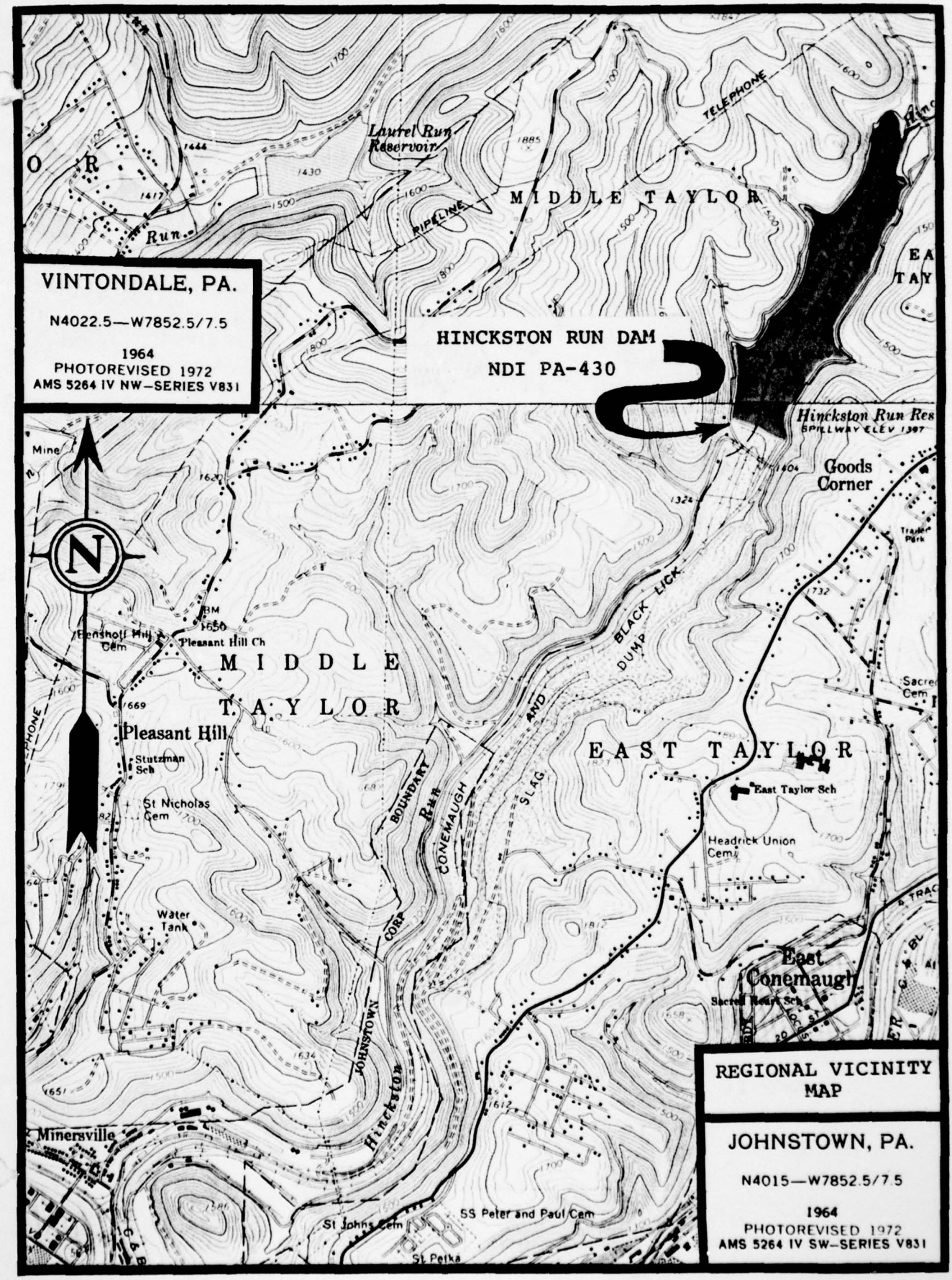
FIGURE 6

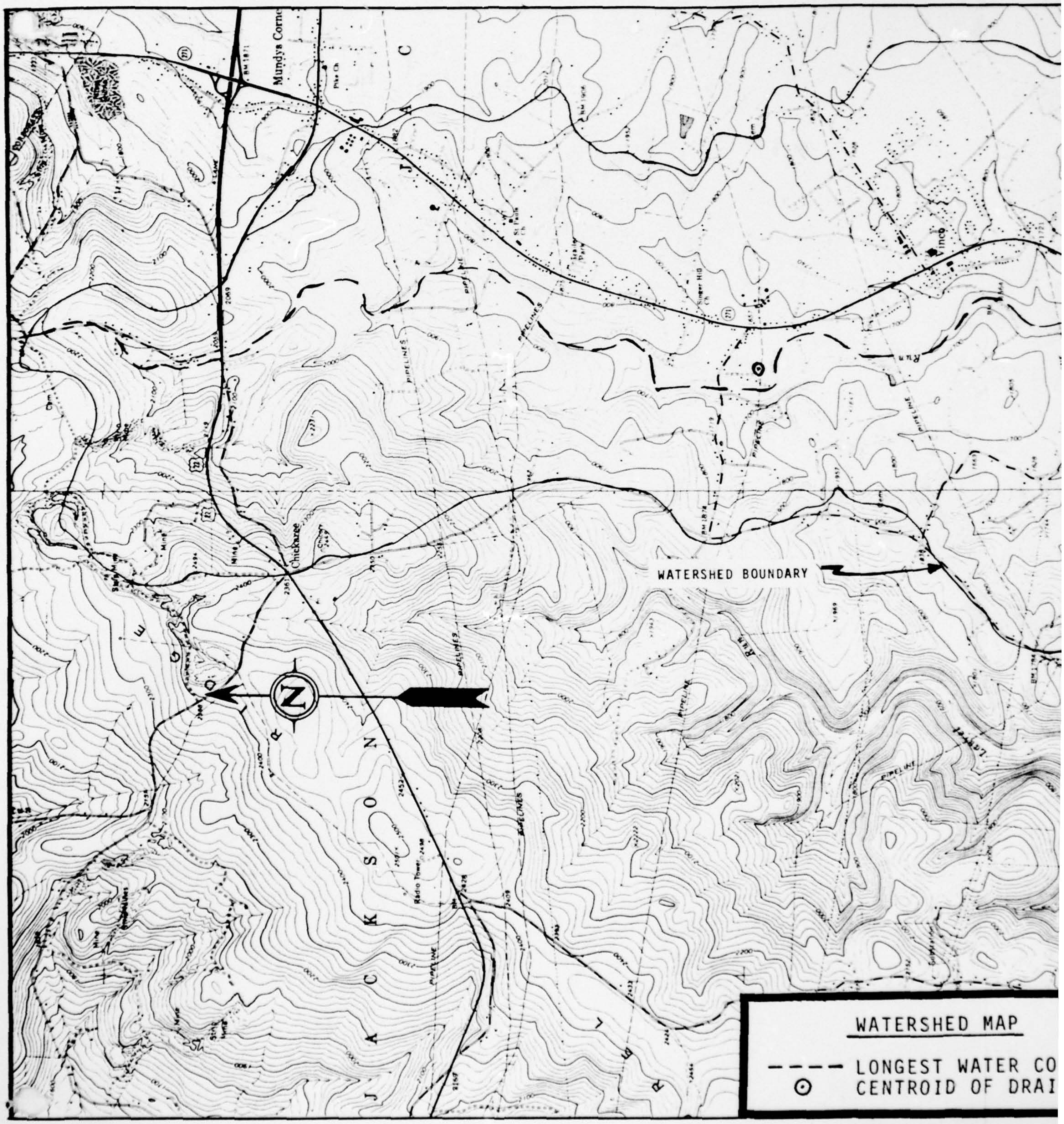
Water Works and Dams
Dams-Valves-Cocks
Arrangement and numbering of valves at Effluent Tower and Valve House, and Dam Storage Capacity-Hinckston Run Dam.
Scale 1" = 1 Foot. Geo. W. Williams.

CAMBRIA STEEL CO.
DRAWING
S8359
MO. MARCH DAY 18TH 1905.

APPENDIX G

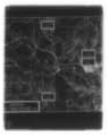
REGIONAL VICINITY AND WATERSHED BOUNDARY MAPS


VINTONDALE, PA.
N4022.5—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV NW—SERIES V831
HINCKSTON RUN DAM
NDI PA-430
Laurel Run Reservoir
Hinckston Run Res
SPILLWAY ELEV 1307
MIDDLE TAYLOR
EAST TAYLOR
Goods Corner
Pleasant Hill
Pleasant Hill Ch
Stutzman Sch
St Nicholas Cem
Water Tank
Minersville
East Taylor Sch
Headrick Union Cem
East Conemaugh
Sacred Heart Sch
St Johns Cem
SS Peter and Paul Cem
St Peika
BLACK LICK DUMP
SLAG
CONEMAUGH
BOUNDARY
CORP
JOHNSTOWN
Hinckston
TELEPHONE
PIPELINE
REGIONAL VICINITY MAP
JOHNSTOWN, PA.
N4015—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV SW—SERIES V831

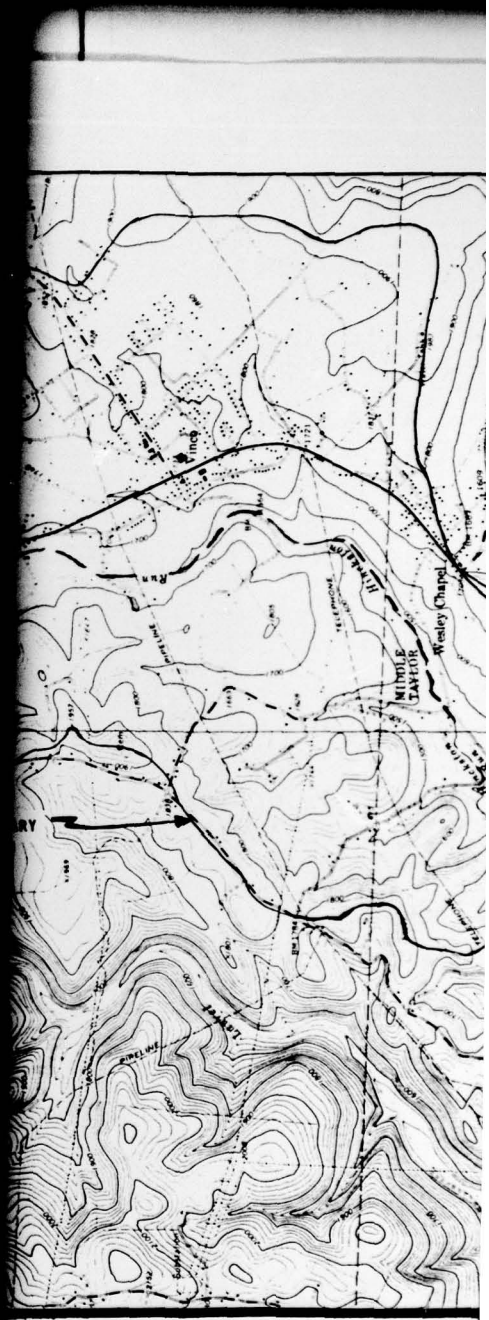

WATERSHED BOUNDARY
WATERSHED MAP
LONGEST WATER CO
CENTROID OF DRAI
Chickaree
Vinco
Mundys Corne
PIPELINES
PIPELINE

AD-A078 997 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. HINCKSTON RUN DAM (NDS I.D. NU--ETC(U)
SEP 79 B M MIHALCIN DACW31-79-C-0013
UNCLASSIFIED NL

2 OF 2
AD-
A078997



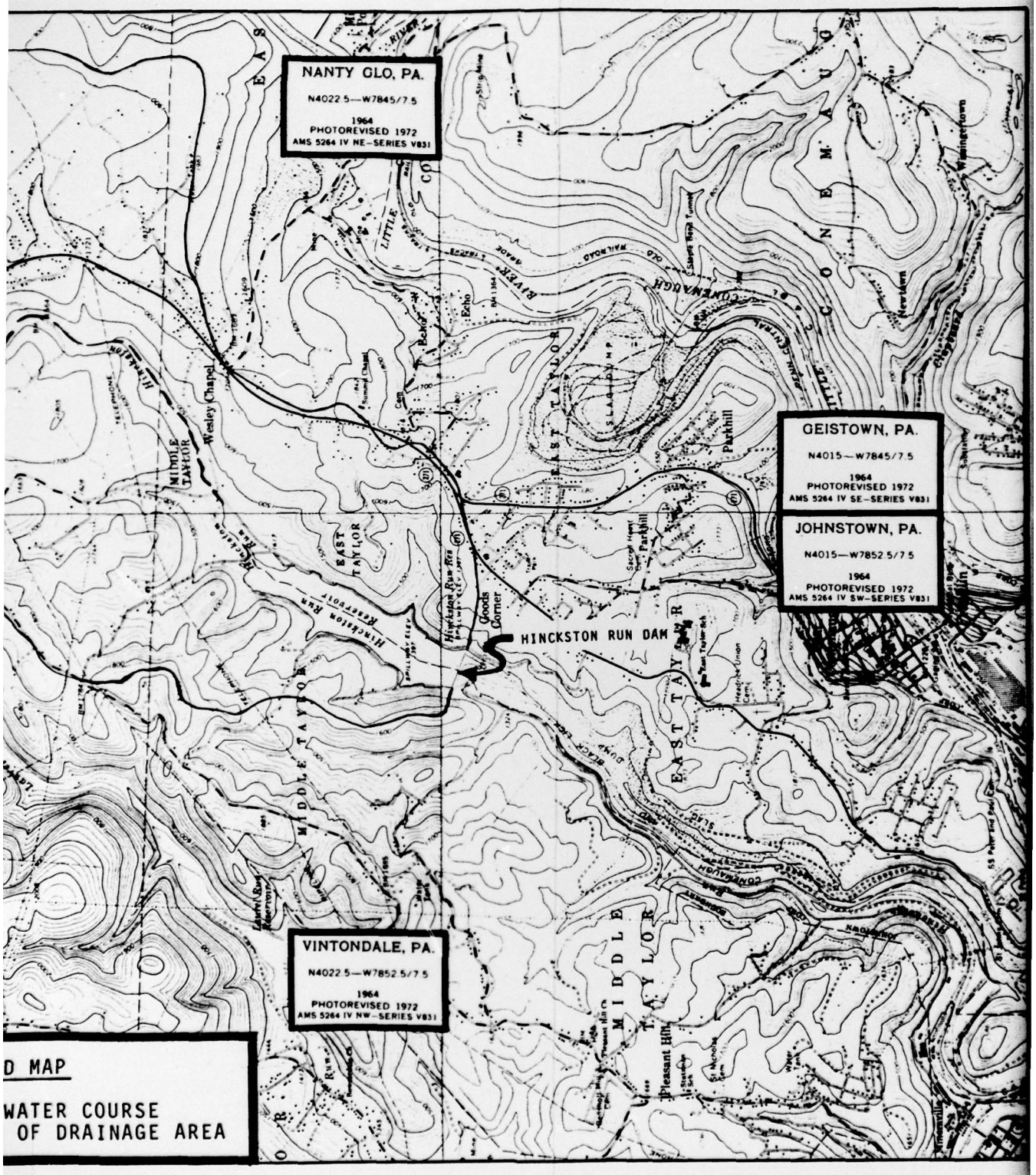
END
DATE
FILMED
2-80
DDC



WATERSHED MAP

--- LONGEST WATER COURSE

⊙ CENTROID OF DRAINAGE AREA


NANTY GLO, PA.
N4022.5—W7845/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV NE—SERIES V831
GEISTOWN, PA.
N4015—W7845/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV SE—SERIES V831
JOHNSTOWN, PA.
N4015—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV SW—SERIES V831
VINTONDALE, PA.
N4022.5—W7852.5/7.5
1964
PHOTOREVISED 1972
AMS 5264 IV NW—SERIES V831
HINCKSTON RUN DAM
Wesley Chapel
Goods Corner
Parkhill
Echo
EAST TAYLOR
MIDDLE TAYLOR
D MAP
WATER COURSE
OF DRAINAGE AREA